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TECHNICAL (FINAL) REPORT

EFFECTS OF ANXIETY LEVEL AND MILD SITUATIONAL STRESS ON VARIOUS PSYCHOLOGICAL FUNCTIONS. THE INTERRELATIONSHIPS AMONG THESE FUNCTIONS, ANXIETY LEVEL AND OTHER PERSONALITY VARIABLES.

- A multivariable and factorial study -

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Contents

A c k n o w l e d g e m e n t s

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I. Introduction

A. General Introduction

As Lazarus (1960) has most amusingly demonstrated, the publication of such techniques as the Taylor Manifest Anxiety Scale (T a y l o r, 1951 = MAS) and similar instruments for the evaluation of anxiety level has been followed by a large number of studies investigating the influence of anxiety on performance and its relationship to other personality variables. Various forms of stress have been employed as a means of introducing an element of situational or "actual" anxiety (as opposed to the general level of anxiety in a given subject), separately or jointly with the investigation of general anxiety level. The evidence supporting the frequently advanced hypothesis of anxiety as a secondary drive which influences performance has been disappointingly scanty, the literature including many negatives outcomes, contradictory results, and replication studies which fail to confirm earlier promising results. The explanation of results of this kind would seem to be particularly difficult when the investigator has been using only a single variable, since he then has no possibility to search his data for more comprehensive alternative hypotheses which might suggest other lines of research. Studies exploring the concept of anxiety and/or stress in a more comprehensive framework are more likely to find that anxiety is not a single dimension, that it should be subdivided into one or more subconcepts, or that more restricted modalities of motivation should be substituted for the general concept of "stress". Unfortunately, studies of this type have appeared only quite

recently and, so far, have mainly been restricted to the work of a few factor analysts whose attention was focused primarily on the exploration of personality concepts rather than on the effect of anxiety on certain psychological functions.

The present study has two general objectives:

(1) To replicate investigations of the effects of general anxiety level and mild stress on a number of single functions for which previous results have been in part ambiguous or contradictory. This seemed to be particularly worthwhile to undertake using a larger and more heterogenous sample of Ss than has usually been studied in single variable investigations.

(2) As a second objective this study attempts to describe the interrelationships between psychological functions of varying complexity and the anxiety level of the individual under stress and under non-stress conditions. A factor analysis suggests itself as the most economical means for this purpose. A comparison with other factor analytic studies of anxiety will be made.

In the course of this paper, the selected variables will first be listed together with a very brief summary of previous findings on each and the hypotheses in respect to the possible outcome of this study. A short summary of factor analytic studies of anxiety follows together with the hypotheses in respect to the outcome of the factor analysis. Next, the subjects (Ss), the testing situation and the technical aspects of the individual experiments will be described. After presentation and discussion of the results on individual variables, the selection of variables for the correlational and

factor analysis will be described. The results of factor analysis and the discussion of the main results of this study will conclude the paper.

B. Stress, Anxiety, and the Selected Tasks

The term stress has been used in various ways, with somewhat different implications. Thus some authors speak of the "induction of stress in the laboratory", implying that stress is to be considered as the reaction of a S. Others speak of "stressfull situations" or "behavior under stress", thus making stress an aspect of the environment. In this paper stress will be understood in the latter sense. Widely varying types of stress have been employed in previous work, e.g. (1) the induction of pain during the testing situation, with or without direct relationship to the task employed, such as heat, electric shock; (2) change of the physical conditions of the experimental situation such as sensory feedback, oxygen deprivation, sensory deprivation; (3) direct threat of a painful stimulus at the end of a task or if the task was failed. Some investigators have used what might be termed (4) "psychologically stress exerting situations" in their experiments. These stresses have included induced failures, suggestion that results were poor and insufficient and/or suggestion that poor performance would reflect on their school record, self-esteem, or group standing. Other researchers used "real-life-stress", testing in situations in which Ss supposedly are under stress already outside of the laboratory, e.g. immediately before examinations, before parachute jumps, during live ammunition field training.

That a stress exerting situation meeting one or all of the above mentioned conditions will arouse anxiety in a given S is only an assumption made by a number of authors but not sustained in critical

studies. The emotion aroused appears to depend very much on the type of stress used and on the personality of the S. F u n k e n s t e i n, K i n g and D r o l e t t e (1953) demand that a stressful situation should be "projective", i.e. should allow for a variety of emotions to appear. They demonstrate that both in failure stress and sound stress Ss reported anything from outwardly or inwardly directed anger to anxiety as well as "no emotion" and "miscellaneous". In his summary C h i l e s (1957) broadens stress into a generic term covering fear, anxiety, frustration and conflict. He points out that the emotional situation produced by a stressful situation may be considered the result of both approach and avoidance tendencies and can be characterized by the arousal of conflicting and competing habits which may produce a variety of different responses. Of particular interest to the researcher is, of course, the result of these competing tendencies on the task-relevant response.

The strength of the effect of a stress exerting situation obviously does not depend only on the general strength of the stimuli employed but also on the previous history of the S. It has often been found that no effect of a particular stressful situation could be observed. The reason for this may be that the kinds of responses that might be elicited by the situation was widely differing for the individual S so that it could not be effectively measured. It may also be possible that a situation assumed to be stressful did not appear that way to the S at all. Some authors have therefore created individual stress for each S on the basis of pretesting or interviews (G r i n k e r et. al., 1957).

In the present study, a general stress situation for all Ss had to be created since individual pretesting was not feasible. Furthermore,

it was necessary to maintain a stressful situation throughout the individual testing session so that the effect of stress on all tasks could be determined. Thus task specific stresses such as shock for wrong responses are not suitable. A combination of four different procedures was used with the intention of making the whole experimental situation mildly stressful for the "stress" subgroups of Ss. These procedures consisted of changes in the form of instructing Ss, in critical remarks about Ss' performance, in the emphasis of apparatus three and in the introduction of failure stress in one task at the beginning of the experimental session. A detailed outline of this will be given in the procedure section of this paper.

A large variety of psychological functions have in the past been found or suspected to be related to anxiety level or stress influence. In the selection of tasks for this study it seemed worthwhile to employ a larger number of tasks and to make an attempt at using a fairly representative cross-section of psychological functions from all levels of complexity. Therefore, a few tasks have been added which have not previously been used in similar investigations but which theoretically appeared to be equally promising. Similarly, a few other tasks have been used in altered form in the present study. In addition, it seemed advisable to include more than a single personality variable ("anxiety level") in order to have more means for the identification of factors in the personality area; it was decided to use a slight modification of the MMPI prime scales for this purpose. For a first inspection of the selection of variables the reader is referred to Table 1. The following summary of previous findings must necessarily be brief, since an adequate resumé in this

T A B L E 1

List of Selected Variables

a. Physiological Variables

1. Galvanic skin conductance, basic resting level
2. Conductance level type (rising or constant)
3. Systolic blood pressure
4. Diastolic blood pressure
5. Pulse pressure

b. Psychophysiological Variables

6. Galvanic skin reaction to emotionally toned visual stimuli
7. Pneumograph reaction to emotionally toned visual stimuli
8. Cardiograph reaction to emotionally toned visual stimuli
9. Myograph reaction to emotionally toned visual stimuli

c. Simple Behavioral Functions

Motor

10. Tapping pressure
11. Tapping speed, 10 sec. trials
12. Tapping speed, 1 min. trials
13. Simple reaction time
14. Simultaneous tasks (Steadiness task with simultaneous tapping).
15. Leg circling

Perceptual:

16. Autokinetic movement: time to report of first movement
17. Autokinetic movement: extent of movement
18. Autokinetic movement: number of direction changes

19. Autokinetic movement: type of movement seen (circular or straight)

20. Autokinetic movement: two- or three-dimensional

21. Flicker fusion frequency: mean frequency over series of trials

22. Flicker fusion frequency: variability over series of trials

d. Complex Behavioral Functions

23., 24. Time estimation, operational (sum over trials and change from first to last trial)

25., 26. Time estimation from memory (10 sec. and 1 min.)

27., 28. Speed of multiple choice decision making (Ser. I, and II & III)

29., 30. Errors in multiple choice decision making (Ser. I, and II & III)

31. Tachistoscopic recognition threshold for emotionally stimulating and neutral words

32. Length of observation of emotionally stimulating pictures

33. -38. Ratings of emotionally stimulating pictures

39. Time required to complete personality questionnaire

e. Test Data

40. -44. Standard intelligence test subtests

f. Personality Questionnaire Data

45. -47. Three MMPI validity scales

48. -57. Ten MMPI personality (clinical) scales

58. German anxiety scale

extensive area of research is beyond the scope of this report.[1] For a number of the variables in question, excellent summaries have been published elsewhere, and the reader is referred to the original and summarizing publications.

As mentioned before, the selection of variables for this study was guided by two principles: a) to include variables that have shown promise of being related to anxiety level or the influence of stress, including those for which findings were ambiguous or contradictory; b) to include variables of differing complexity to achieve a somewhat representative coverage of a wide range of psychological functions. These aims were necessarily limited by considerations of economy of apparatus, transportation, testing time, availability of clearcut experimental designs, length of pretesting and last but not least - the patience of our Ss to undergo the experiment. Some of the tasks have been preferred to others simply because the length of the individual testing session had to be limited, or because a particular apparatus and a relatively simple scoring method for the results was available. It is particularly regrettable that it was not possible to include one of the classical conditioning experiments in our battery. These experiments seem to show fairly convincing evidence of the influence of anxiety level and stress, but they are quite time-consuming and therefore not feasible for inclusion in this study.

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[1] An attempt will be made, however, to give a more extensive survey of the literature in another publication (to be issued as a technical note later).

a) Physiological Variables

Galvanic Skin Conductance, Basic Resting Level (BSC).

Whereas most authors have been concerned with the galvanic skin reaction rather than the basic conductance level, the few available studies seem to yield contradictory results. Correlations between BSC and MAS level were found insignificant (S i l v e r m a n and B l i t z, 1956, S i l v e r m a n, 1957, R a p h e l s o n, 1957) and the correlation between a Test Anxiety Scale (M a n d l e r and S a r a s o n, 1952) and BSC were found highly positive (M c D o n n e l l and C a r p e n t e r, 1960), low positive (S i l v e r m a n, 1957) and insignificant (R a p h e l s o n, 1957) during a testing period. Under threat of shock conditions correlation between test anxiety and BSC was found highly negative (S i l v e r m a n, 1957), whereas in another study expectation of an ego-involving task conditions seemed to result in a slight positive correlation (R a p h e l s o n, 1957). A curvelinear relationship between BSC and anxiety has also been suspected. It appeared worthwhile to include BSC in our investigation - which uses an anxiety scale constructed on the basis of three other scales[1] - in order to find some new evidence. On the basis of previous evidence it might be expected that (a) Ss with high anxiety level show higher BSC and that (b) Ss tested under stress conditions tend to have higher BSC.

Whereas BSC level stayed constant for most Ss, it was found that for a few Ss BSC was rising during the whole of the stimulus period. This phenomenon was analysed; results for this variable will be considered as exploratory only.

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[1] see section II, B

Systolic, Diastolic Blood Pressure, and Pulse Pressure:

Clinical experience and experiments based on clinical judgments of patients (A c k n e r, 1956, S t ö r r i n g, 1958) show some evidence that vasomotor activity varies positively with anxiety level. Further supporting evidence comes from stress tolerance tests of various kinds, which, however, usually prefer pulse frequency as measure of heart activity (C o h e n et. al. 1957, K i n g and F u n k e n s t e i n, 1957, M a l m o and S h a g a s s, 1949, a,b, S c h a c h t e r, 1957). In these studies anxiety was related to higher vasomotor activity. One study (D e a n e and Z e a m a n 1958) yielded opposite results under condition of structured anxiety (or fear) and unstructured anxiety, the first showing a slowing down of pulse rate whereas the latter produced acceleration. C a t t e l l and S c h e i e r (1961) report positive loadings of systolic blood pressure and pulse pressure on their anxiety factor in many studies under survey. Aside from this factor analytic work, no studies were found relating these measures to anxiety as measured by standard questionnaires in a normal population. However, there appears to be fairly good evidence that systolic and diastolic blood pressure are positively related to general anxiety level in patients as well as to strongly anxiety provoking situations in normal Ss. Less clearcut evidence exists for such a relationship between pulse pressure and anxiety.

For the three measures in this study, taken from a normal population in a standard testing situation and under conditions of mild stress it might be expected that (a) Ss with higher anxiety level tend to have higher scores and (b) Ss under stress conditions tend to have higher scores than Ss under non-stress conditions.

b) Psychophysiological Variables

The number of variables summarized as "psychophysiological" consists of those physiological changes which occur only after exposure to a specific stimulus. The basic rationale, founded on numerous reports in the literature (see e.g. M o r g a n and S t e l l a r, 1950, or F r e e m a n, 1948) is that autonomic changes concomitant with emotional reactions to certain stimuli are greater (1) the stronger the stimulation and (2) the greater the individual S's emotional reaction to the stimulus; and further (3) that the amount of change can be observed in a given S is also dependent on the S's individual reactivity level. A number of theories have been proposed in connection with the last hypothesis, primarily that the general reactivity level can be manipulated by raising or lowering the level of certain drives, such as anxiety. Following this, both the high anxiety Ss as well as the Ss under stress should be expected to show greater reactivity on these variables than low anxiety Ss and Ss under non-stress conditions.

Galvanic Skin Reaction (GSR) to Visual Stimuli:

The evidence supporting the hypothesis that the GSR appears more frequently and stronger in anxious than in non-anxious Ss in a simple stimulus situation is not very convincing. C o h e n, S i l v e r m a n, and S h m a v i n i a n, (1960) and M a n d l e r, M a n d l e r, and U r v i l l e r (1958) find some evidence for this hypotheses whereas B a n g h a r t, B a c h r a c h, and P a t t i s h a l l (1959) found no support in a problem solution situation. Using emotionally toned stimuli, H e r r and K o b l e r (1953 found GSR closely connected with neuroticism. A number of studies seem to suggest that GSR reactions are most easily obtained when stimulus materials are selected which are highly related to problem areas of the individual S as determined by previous tests

or interviews - that is, there may not be certain general classes of stimuli to which anxious Ss react with strong GSR. No evidence is available on the effects of mild situational general stress on the amount of GSR to specific emotionally toned stimuli.

Considering the stimulus material[1] used in this study, the following hypotheses can be made: (a) The more emotionally arousing stimuli will elicit more reactions than relatively neutral material, and (b) Ss with high A scale level will tend to have more reactions than Ss with low anxiety level. The application of mild situational stress in this study can, for this variable, have only exploratory value.

Pneumograph Reaction to Visual Stimuli:

Pneumograph recordings - although frequently used in lie detection and experimental situations investigating emotional behavior (H a r n e y, 1943, I n b a u, 1943, S t e v e n s o n and R i p l e y, 1952) - have not been used very often in problems similar to this study. S t e v e n s o n and R i p l e y report both increased and decreased respiration rates and depth in patients with anxiety states during an emotionally arousing situation as compared to their normal behavior. Using normal Ss, however, D e n n e and M e a m a n (1958) failed to find a significant correlation between respiratory measures and two different emotionally arousing situations. R a p h e l s o n (1957) found no relationship of breathing pattern with anxiety level as measured by the MAS, the Sarason Test Anxiety Scale, or with situational anxiety.

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[1] described in section II, B

Based on the general considerations about autonomic reactivity outlined in the beginning of this section the hypothesis will be tested that (a) more emotionally arousing stimulus material elicits more pneumograph reactions in all Ss and (b) that high anxiety Ss show a greater number of reactions than low anxiety Ss. Results under stress conditions will be considered as exploratory.

Cardiograph Reaction to Visual Stimuli:

No evidence could be found relating heart rate and/or blood pressure changes to anxiety as measured by standard questionnaires in normal Ss. or of the differential reaction of anxious and non-anxious Ss to different kinds of stimulus material. However, the expectation of a stimulus and stimulation by various kinds of material including emotionally stimulating material have been shown to increase both heart rate and blood pressure for short periods (B e r g and B e e b e - C e n t e r, 1941, D a r r o w, 1936, N i s s e n, 1928). Therefore, no definite hypothesis concerning the outcome of the analysis of variance for anxiety and stress will be advanced; rather, the results should be considered as exploratory. Similar to the previously mentioned psychophysiological variables, however, it may be expect that the stronger emotionally arousing material will elicit more cardiograph reactions than relatively neutral material.

Myograph Reaction to Visual Stimuli:

Since the type and locus of measurement varies considerably from one study to another, comparison of previous studies to the present one has serious difficulties. Both D u f f y (1957) and M a l m o (1957) agree in their surveys of the literature that the myogram appears to be a useful indicator of the energetic level (arousal, motivation, drive level) of the human organism. Thus anxiety can

be expected to be positively correlated with muscle activity. R o s s i (1958) found such a positive correlation between EMG and MAS during a reaction time task, although M a r t i n (1953) did not find such a relationship with a neuroticism scale. In two studies neurotics showed higher muscle tension as compared to normal Ss (J a c o b s o n, 1939, S h a g a s s, M a l m o and D a v i s 1950). Concerning the effects of various experimental procedures on muscle potentials, it has been established that stimulation by intellectual tasks increases muscle activity (D a v i s, 1939, J a c o b s o n, 1932, S h o w, 1938). Two studies have indicated that stress increases muscle activity (M a l m o and S h a g a s s, 1949, a, R y a n, C o t t r e l l and B i t t e r m a n, 1950).

Although no satisfactory evidence can be found as to whether a correlation between myograph reactions and anxiety level as measured by questionnaires exists, it may be hypothesized on the basis of the R o s s i study and on the basis of the general considerations outlined at the beginning of this section (a) that Ss with high anxiety level will show more myograph reactions than Ss with low anxiety level and (b) that Ss in stress situations will show more myograph reactions than Sc under non-stress conditions; finally, (c) that the more emotionally stimulating material will arouse more reactions than relatively neutral ones.

c) Simple Behavioral Functions:

Motor:

Tapping pressure:

This variable has rarely been used so that no results of previous studies are available. Therefore, the results for this variable will be considered as exploratory only.

Tapping Speed:

This task was included to cover another kind of motor activity in addition to the ones selected on the basis of previous studies. There appeared to be no studies available investigating the relation of general anxiety level and tapping speed. R o s s, H u s s m a n and A n d r e w s (1954) found although stress-produced anxiety (as defined by the authors: fear of physical harm in a boxing match) and exhaustion (after the match) seemed to decrease tapping performance, their measures lacked reliability. Another study (B e r r i e n, 1939 a,b) reported that in rhythmical tapping tasks efficiency was decreased by emotional arousal.

Since no sufficient evidence is available to advance a definite hypothesis, the results for this variable will also be considered as exploratory only.

Simple Reaction Time:

A number of studies have investigated the relationship between this generally well studied performance and anxiety; quite a few of these have been concerned with the relative effects of relevant and irrelevant drive (e.g. of threat of shock in slow performance and general drive level or anxiety level). The results of these studies are not entirely consistent. W e n a r (1954) found shorter RT in anxious Ss with all stimulus intensities, whereas C a s t a n e d a (1956) found that the effect of anxiety level was leveled out when different stimulus intensities were used; i.e. high anxiety Ss had fast RTs with strong stimuli in comparison to low anxious Ss, but slower RT with weak stimuli. F a r b e r and S p e n c e (1956) failed to establish any relationship between anxiety level and RT or between stress (threat of shock) and RT. K a m i n and C l a r k

(1957) found negative correlations between general anxiety level and simple reaction time under both stress and non-stress conditions. C a t t e l l and S c h e i e r (1961) find positive loadings of medium to insignificant size for slow reaction time (irregulary warned) on their anxiety factor.

Drive theory has thus not been very successful in predicting the outcomes of reaction time experiments. The wealth of contradictory empirical evidence suggests that there is no simple relationship between anxiety level, stress, and reaction time, and that no group differences can be expected in a study such as the present one. However, because of the extent of previous work with this variable and the inconclusiveness of these results the inclusion of it in the present study seems worthwhile.

Simultaneous Tasks (Steadiness task with simultaneous tapping): If two simple motor tasks are performed simultaneously, performance on both tasks may be expected to decrease in a degree related to the complexity of the tasks, the degree of similarity of the two tasks, and the mode of response (i.e. whether both responses have to be made by the same hand, hand or foot, verbally, etc.) Our choice of this task, keeping a constant pressure with visual control on one hand and tapping with the other, was made for the sake of simplicity of performance and of apparatus. A pilot study showed a considerable, but not excessive amount of interference between the two tasks.

The only available reference for a somewhat related variable is C a t t e l l and S c h e i e r's (1961) report of a small positive loading of " low hand steadiness" on their anxiety factor. Since no studies about the effect of anxiety level or stress on a

simultaneous task are available, a tentative hypothesis was developed: assuming that attention is more fixed and inflexible in a more anxious person, the performance of two tasks simultaneously may be expected to cause more difficulty for them since a constant fluctuation of attention is required. This hypothesis is in accordance with A r n o l d's (1957) theory that Ss with less flexibility of attention are Ss of a more rigid personality type who are more likely to experience anxiety. Stress conditions might be expected to bring out this difference to an even greater extent.

Leg Circling:

This gross motor variable was included because of its positive loading for high tempo on C a t t e l l's anxiety factor (C a t t e l l and S c h e i e r, 1961). No results are available about high and low anxiety group differences or the effect of stress on this variable.

The tentative hypothesis may be made that Ss with high anxiety will make more circles per minute. No specific hypothesis about the influence of stress conditions on this variable will be advanced.

Perceptual:

Autokinetic Movement.

Since S h e r i f's (1935, 1936) initial study, AM has been investigated mainly as a phenomenon that can be easily influenced by suggestion in a social situation. Also, various technical modifications of the experiment have been studied. Very little is known, however, about personality characteristics that might be responsible for individual variation on this task either in a social situation or in an individual examination. S c h w a r t z and S h a g a s s

(1960) found no significant relationship between the amount of AM reported and the psychiatric diagnosis of depression, neurosis, personality deviation, and schizophrenia. V o t a (1941) found "that some individuals possess, more than others, a certain resiliency of attitude or fluctuation of mood which lends itself more readily to the particular experimental situation here involved" (pg. 319). He found that highest amount of AM was reported when the S got strongly involved in the experiment or, as the author interprets it, when "anchorage in objective reality" (in the L e w i n sense) was reduced. T e n e r l i n (1956) found that AM was considerably larger in Ss that showed "extremely flexible and productive behavior" in a previous f. . association test. No studies, however, investigating the effects of anxiety level or stress are available. This variable has been included here only as an important sample of the simpler perceptual functions. Results therefore will be considered as exploratory only.

Flicker Fusion Frequency:

K r u g m a n (1947), B ü h l e r (1955), G o l d s t o n e (1955) and J o n e s (1956) all found a negative correlation between FFF and anxiety, measured by a variety of scales and ratings. Intra-individual variability of FFF measurements were also found to be higher in anxious Ss. D o n d e r o, H o f s t ä t t e r and O'C o n n o r (1958) did not, however, find a significant relationship between MAS scores and FFF; only when they excluded five Ss with extremely high MAS scores did they find a rather low correlation similar to the results of the other authors. Similar results were found by W a g o n e r (1956). E y s e n c k (1952) found a very small negative correlation in anxiety neurotics and hysterics.

V i e r (1956) reports that conflict situations with threat to social prestige tend to lower the FFF. No other results on the effect of stress on FFF could be found.

On the basis of these results, the following hypotheses may be advanced: (a) FFF will be lower in high anxious Ss, and (b) Ss under mild situational stress conditions will have lower FFF than Ss under non-stress conditions.

d) Complex Behavioral Functions

Time Estimation:

Various aspects of time estimation have been reviewed by C l a u s e n (1950) and F r a n k e n h a e u s e r (1959). P o s t m a n and S c h n e i d e r (1951) found this task ideal for the investigation of effects of directional and motivational factors since it fulfills the condition of having "poorly structured stimulus information" which can be easily influenced by such factors. Need-tension and induced anxiety (expectation of pain) have in some experiments been shown to cause overestimation of time (F a l k and B i n d r a, 1954, F i l e r and M e a l s, 1949, H i n d l e, 1951, P o s t m a n and S c h n e i d e r, 1951, R o s e n z w e i g and K o h t, 1933). The influence of anxiety level, however, has not been investigated, except that a small negative loading on the anxiety factor for underestimation of time while working is reported in one of the studies reviewed by C a t t e l l and S c h e i e r (1961). The same study mentions also "low accuracy of prediction of time needed in task" as having a low negative loading on the anxiety factor.

Although no studies of direct relevance to the exact task and the type of stress employed in this study are available, the following

tentative hypotheses may be made (a) The estimates of the high and low anxiety groups will differ significantly on both the operational and memory estimation tasks, the anxiety group tending to overestimation, and (b) the application of stress will produce overestimation on both tasks for both high and low anxious groups, resulting in a significant difference between stress and non-stress groups.

Multiple Choice Decision Making:

This experiment, essentially an adaptation of H a l s t e a d's Category Test (1947) is one of the best marker variables on H a l s t e a d's Factor A ("abstraction ability") of his "biological intelligence" with high loadings also on Factor C ("central integrative field factor"). In the original form of this test only the error score is used. In this study a time score is used in addition, indicating the speed with which a fairly complex decision is made.

None of the scores of this particular test have previously been used in studies of anxiety. Some studies, however, seem to indicate that "flexibility of intellectual functioning" or "rigidity in problem solving or concept-formation tasks is related to anxiety level. (A t e , 1955, B r a n s o n, 1957, H o l b r o o k, 1954, M a l m o and A n s e l, 1948, R o m a n o v, 1956, R u e b u s h, 1960, S i e g m a n, 1956, W e s l e y, 1953, etc.). Others do not confirm this hypothesis (A t e, 1955, D a n g h a r t et. al. 1959, K o r c h i n et. al. 1957, W e s t r o v e, 1953, etc.). The direction of differences between anxiety groups seems to confirm, in some instances, the S p e n c e - T a y l o r theory that Ss with high anxiety level are superior to low anxioty Ss on tasks with weak competing tendencies, but inferior when competing

tendencies are strong (Summary by A t k i n s o n, 1960).

In regard to the time scores of such tasks, previous results have been ambiguous, (K o r c h i n et. al., 1957, M a l m o and A n s e l, 1948, R u e b u s h, 1960), although C a t t e l l and S c h e i e r (1961) report positive loadings on their anxiety factor of comparable variables, e.g. "slow complex decision reaction time", "slow speed of perceptual judgment".

Anxiety induced by "ego-involving", "threatening" or otherwise stressful situations have shown varying degrees of influence on performance on comparable tasks (B e i e r, 1951, C o w e n, 1952 a, b, C o w e n et. al., 1957, S p e n c e r, 1957, T o m b l e n, 1957), and studies of the interaction effect between anxiety and stress have found that performance under stress conditions shows a decrement in high anxiety Ss but an increment in low anxiety Ss as compared to a non-stress situation (Summary by A t k i n s o n, 1960).

In the light of these previous studies, it may be expected that (a) Ss with high anxiety level will make more errors and take more time on this task than low anxiety Ss; (b) that this difference will be greater under stress conditions; i.e., an interaction effect of stress and anxiety may be expected.

Tachistoscopic Recognition Threshold for Emotionally Stimulating and Neutral Words:

This variable has been used in a large number of experiments investigating the concepts of "perceptual vigilance" and "perceptual defense" (Summary by P o s t m a n, 1953, E r i k s o n, 1954). The general perceptual defense hypothesis, in brief, maintains that threatening material will be perceived with more difficulty than

neutral material through operation of a defense mechanism against the threat-an operation to avoid anxiety. That emotionally stimulating material of a "taboo" nature, presented under standard experimental conditions, requires more trials until the S reports it has been fairly well established, although whether this is a function of threat and defense mechanism remains a topic of dispute. Only two studies have attempted to determine whether anxiety level will increase the difference in recognition time for taboo and neutral words. Both of these studies failed to find a significant relationship between recognition time and anxiety level (B i t t e r m a n and K n i f f i n, 1953, C h o d o r k o f f, 1956). S m o c k (1955), assuming that anxiety is disruptive to performance involving competing responses, hypothesized that highly anxious Ss would have higher thresholds for all words than Ss with low anxiety, but that for words associated with threat (in his study neutral words preceded by threatening words at long exposure time) this difference would increase. The predicted overall difference between high and low anxious Ss was clearly demonstrated, as well as increased recognition time for threat-associated words for all Ss, although the predicted interaction between anxiety level and threat was not found.

Considering these findings, the following hypotheses may be made for the present study: (a) High anxious Ss will have higher thresholds for both emotionally stimulating and neutral words than low anxious Ss. (b) All Ss will have higher thresholds for emotionally stimulating words than for neutral words. (c) The difference in thresholds between emotionally stimulating and neutral words will be the same for high and low anxious groups; that is, no interaction between anxiety level and type of word is expected.

Since no relevant studies on the effects of general stress (as opposed to threat association attached to a particular word) are available, results for stress and non-stress conditions and interaction of A-scale level and stress will be considered as exploratory.

Length of Observation of Emotionally Stimulating Pictures:

This measure, one of the five different responses recorded while Ss were viewing emotionally stimulating pictures (see psychophysiological variables, nos. 6-10) has not been used previously in this form. Since the instructions requested that S view each picture thoroughly and long enough to make a rating about its emotional content the Ss were free to proceed to the next picture at their own pace.

On the assumption that S will seek to avoid anxiety-arousing stimuli (a general proposition related to the more specific perceptual defense hypothesis), it may be expected that the more anxiety-arousing pictures will have shorter viewing time than the neutral ones for all Ss. (This experiment is not, of course, directly comparable to perceptual defense studies. The present experiment allows S voluntary control over the duration of his exposure to the stimulus). In addition, Rorschach and TAT plates (Categories V and VIII) are expected to have puzzling characteristics which will cause S to take more viewing time. This leads to the first hypothesis, that of a significant between-categories effect.

With respect to anxiety, high anxious Ss may be expected to have greater difficulty in structuring the ambiguous material of categories V and VIII sufficiently to make a rating. It is found fairly consistently in clinical use of the Rorschach that more

disturbed (neurotic-anxious) patients have longer reaction times to new cards (the various so-called "shock" phenomena). It is therefore expected that the high anxious Ss will have longer viewing times for categories V and W,I than the low anxious Ss. For the threatening pictures, on the other hand, it is expected that high anxious Ss will show a more pronounced tendency to avoid these than the low anxious Ss, who may be expected to be less disturbed by them. Thus a hypothesis of anxiety level-categories interaction may be made, with the low anxious group showing less between-category variability.

The application of mild situation stress is expected to increase the differences between categories in the predicted direction for all Ss, but to a lesser extent for the low anxious Ss, resulting in a stress-anxiety-categories interaction.

Ratings of Emotionally Stimulating Pictures:

Although this variable was introduced partly to secure S's full attention to the pictures, it was also scored and analyzed in order to compare the ratings of the four groups of Ss. Ss were required to rate each picture as either "exciting", "repellent" or "humorous" and to indicate whether it was mildly, moderately, or strongly so. Ratings in this form have not been used previously in comparable studies. On the basis of a general anxiety theory one would expect, however, that the stronger anxiety response aroused in Ss with high general anxiety level would also influence their rating of the different categories of pictures used as stimulus material. In this study, two categories of pictures were used that might be described as "shocking" stimuli (scenes of destruction, and corpses); two categories of "humor" pictures (cartoons), two categories of

ambiguous pictures (Rorschach plates, TAT cards), one category of "police action" pictures, and one category of "court scenes" pictures. A detailed description of the selection of categories and pictures will be given in the procedure section of this paper.

(a) On the basis of the above mentioned rationale it was predicted that Ss with high anxiety level would judge "shocking pictures" (Categories I and II) more often "repellent" in comparison to low anxiety Ss, and

(b) That in judging these pictures as repellent high anxiety Ss would prefer the stronger statement rather than calling them mildly or moderately repellent.

(c) D o r i s and F i e r m a n (1956) found a preference for aggressive cartoons in Ss with high test anxiety level. C a t t e l l and S c h e i e r (1961) report positive loadings on the following variables of their anxiety factor: "Prefer non-disturbing vs. disturbing pictures", "humor factor cold realism", "humor factor mistreated humor", "humor factor good-natured play vs. dry wit", "humor factor flirtatious playfulness vs. gruesomeness". These somewhat related results support a hypothesis that high anxiety Ss would judge cartoons more often to be humorous than low anxiety Ss, and

(d) that in judging these pictures as humorous high anxiety Ss would prefer the stronger statement rather than calling them mildly or moderately humorous.

(e) Based on the assumption that a S with high general anxiety level would be more likely to interpret an ambiguous picture as threatening and to avoid threatening stimuli than a S with low anxiety level, it was predicted that high anxiety Ss would find the Rorschach plates more often "repellent" as compared to low anxiety Ss, and

(f) that Ss with high anxiety level would prefer the stronger ratings in judging Rorschach plates as repellent.

(g) Finally, based on the general assumption made in the preceding paragraph, it was expected that Ss with high general anxiety level would generally prefer the stronger ratings in their judgements, thus reaching a higher overall rating score than Ss with low anxiety level.

No hypotheses were made in respect to the effect of stress on the ratings although one might speculate that differences in the directions described above might be more pronounced in Ss under stress conditions.

Time Required to Complete Personality Questionnaire.

Since time required to perform complex tasks appears to increase with anxiety level, one might expect that time required to fill out the complete MMPI might also be influenced. Since no relevant studies are available as to the possible outcome of this variable, it was tentatively assumed that Ss with high general anxiety level would be somewhat slower in comprehension and answering as a function of their stronger involvement with the questions presented. No hypothesis in respect to the stress condition could be made since this test was given in a group testing session without application of stress.

e) Test Data

Standard Intelligence Test Subtests:

The overall standard score of this test was used for the matching of groups and therefore could not be used as an experimental variable. The standard scores on the five subtests, however, were analyzed with respect to anxiety level. Since no evidence could be found

in previous studies[1] as to the relative difference of intelligence subtests for high and low anxiety groups, this analysis was considered as exploratory and no particular hypothesis was advanced.

f) Personality Questionnaire Data

Three MMPI Validity Scales and Ten MMPI Clinical Scales:

A large number of studies have been concerned with the relationship between anxiety and the MMPI scales, an even larger number with the construction of anxiety scales or anxiety indices from the MMPI material (Summary in W e l s h and D a h l s t r o m, 1956, D a h l s t r o m and W e l s h, 1960). Two of the three scales (T a y l o r, 1953, W e l [illegible] 1952) from which the anxiety scale used in this study was derived were based on MMPI material. There is therefore much item overlap between the MMPI and these anxiety scales, reflected in the fairly high intercorrelation between scales. Thus, the Taylor scale borrows heavily from the Pt, D, and Hs scales which (together with the Hy scale) have been shown to give another estimate of clinical anxiety as sum scores or weighted scores (M a d l i n, 1947, W e l s h, 1952). To the extent that itemoverlap exists between the A scale and the MMPI

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[1] One reason for this is the composition of the intelligence test used in this study. Studies with other intelligence tests showed no significant correlation between IQ and anxiety level when the intelligence level for groups was held constant (D a n a, 1957, L a u n d, 1954). H a n d l e r and S a r a s o n (1952) report a slight negative correlation. Of the 12 "anxiety-signs" in the Wechsler intelligence test proposed by R a p h k i s and W e l s h (1946) only one ("slow on arithmetic tasks") might be comparable with one of the subtests used in this study (subtest 4).

scales some positive relationship will have to be expected. This positive relationship will also be expected because the MMPI scales are to a considerable extent measures of a "personal discomfort or distress" dimension (W e l s h, 1956)[1]. It seems worthwhile, however, to analyze this relationship for each scale, since the specific validity content of the particular scale will also exert its influence on the relationship. For the analysis of variance, no clearcut discrimination between these interwoven sources of variance will be possible, but the question can be followed up further in the factor analysis of results. Thus, in variance analysis no more than a confirmation of the previously demonstrated positive relationship between the anxiety scale and all standard scales can be expected. As far as the validity scales are concerned, the negative relationship between the K scale and the clinical scales (M e e h l and H a t h a w a y, 1946) would lead one to expect that this "suppressor variable" is also negatively related to the anxiety scale. This relationship will also be emphasized by the fact that an overlap exists between items of K and scales Hs, D and Hy (K scored in the opposite direction). For the F scale, no serious item overlap with other scales (except Sc) exists, so that in this case no artificial relationship between F and the anxiety scale can be expected. Since elevation of the F scale is usually interpreted as an indication of unconventionality of thought content, emotional disturbance, confusion, and failure to understand the statements

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[1] This problem will have to be considered in connection with the discussion of an anxiety factor (see section I, c.)

(H a t h a w a y and M c K i n l e y, 1951, G o u g h, H a r r i s and B l a c k, 1953) it may be expected that F should be slightly higher in Ss with high anxiety level. No prediction can be made for possible group differences on the L scale.

Anxiety scale:

This scale was used for group selection and matching only.

C. The Question of an Anxiety Factor

Ever since F r e u d focused attention on anxiety as a general dynamic agent in normal as well as abnormal persons, the concept of anxiety has been more or less one of a unitary personality trait (drive, symptom, neurotic sign, warning signal etc.). In the course of numerous clinical observations and interpretations various modifications of the concept have been made, and in some theories fear has been treated as a separate although highly related entity. Various summaries of these many differing and often contradictory theories are available (e.g. C a t e l l and S c h e i e r, 1961, M o w r e r, 1960). The advance of psychometrics produced a number of measurements of anxiety, validated against clinical evaluations, thus opening the road for experimental studies on anxiety in human Ss. Results of this research have been, as previously indicated, highly disappointing. In the face of so much negative and contradictory evidence, the question arises whether we are in fact dealing with a single dimension which has a simple and consistent influence on psychological functions. Results suggest that many other sources of variance have been effective in these experiments, as many workers have indicated in their discussion of results. It seems likely that the interaction of anxiety with these other variables is complex and can best be investigated by including larger numbers of variables

(including several measures of personality traits) in a single study and by employing correlational techniques.

In addition to some authors who do not view anxiety as an entity on theoretical grounds or on the basis of observations and experiments, a number of studies employing factor analyses of anxiety scale items seem to suggest that anxiety may not be a single factor. Several factors were distinguished in these studies such as (1) "chronic anxiety or worry", (2) increased physiological reactivity, (3) sleep disturbance associated with inner strain, (4) sense of personal inadequacy, (5) motor tension (O'Connor, Lorr and Stafford, 1956), two of which (No. 1 and 2) were subsequently identified as similar to Eysenck's neuroticism factor, whereas No. 4 was found to be related both to a neuroticism and introversion factor (Bendig, 1958). In another study Bendig (1960) factor analyzed 11 different inventory scores including several neuroticism and anxiety scales. The four factors appearing were identified as (1) emotionality, (2) extraversion-introversion, (3) falsification and (4) sex. Taylor's anxiety scale and Cattell's two anxiety scales (overt and covert anxiety) as well as the combined Cattell scales loaded highly on factor 1, as did various neuroticism scales (with negligible loadings on the other factors extracted). The author concludes that anxiety and neuroticism cannot sufficiently be separated in questionnaire data.

Dixon, De Monchaux and Sandler (1957), however, found that from the Tavistock Self-Assessment Inventory four different anxiety factors could be isolated: (1) social timidity, (2) fear of loss of control, (3) fear of exhibitionism and (4) fear of revealing inferiority.

Several studies have attempted to factor analyze the large number of items contained in the Minnesota Multiphasic Personality Inventory (MMPI). One factor in particular has repeatedly been found although the interpretation of this factor differed from "general degree of disturbance" (M o r r i s, 1947), "anxiety or emotional upset" (W e l s h and D a h l s t r o m, 1956) to "personal discomfort and distress" (D a h l s t r o m and W e l s h, 1960). With slight differences in loadings the same factor was found by W i l l i a m s and L a w r e n c e (1954) and interpreted as psychotic or general maladjustment factor. W h e e l e r, L i t t l e and L e h n e r (1951) also interpreted it as a psychotic factor. It was also replicated in a study by [illegible] (1952). A second MMPI factor (with high positive loadings on Hy, D, high negative on Ma and occasional positive loadings on Hs) was interpreted by D a h l s t r o m and W e l s h (1960) as "repression" with the mechanisms of denial, rationalization and lack of effective self-insight. It was confirmed by F i s h e r (1957) and by K a s s e b a u m, C o u c h and S l a t e r (1950) who interpreted it as an introversion factor; by W i l l i a m s and L a w r e n c e (1954), interpreted as expression-repression factor; and by W h e e l e r, L i t t l e and L e h n e r (1951) who interpreted it as neuroticism. Other factors that occasionally appeared but that so far lack confirmation are "lack of control" (factor C) and "psychoticism" (factor P) (D a h l s t r o m and W e l s h, 1960).

Such studies, of course, are usually restricted in scope by the items of the inventories or the type of inventory used, as well as by the fact that no other kind of information other than self-evaluation is used. Another method of clarifying clinical terms

such as anxiety may be exemplified by a study in which psychoneurotic symptom ratings were factor analyzed. In this study (O'C o n n o r, 1953) eight factors appeared: (1) obsessive-compul ive, (2) physiological anxiety reaction, (3) anxious hostility reaction, (4) clinical anxiety reaction, (5) depressive agitation, (6) psychogenic gastrointestinal syndrome, (7) asthenic reaction, and (8) inferiority reaction. Factors 3 and 5 were previously found by G r i n k e r and S p i e g e l (1945), factor 7 by H a l s t e a d (1949) and factor 8 by M o s i e r and L a y m a n (1937). Other studies have tried to integrate self-ratings, anxiety scales, clinical ratings, and objective measurements such as blood pressure. W i l e n s k y (1957) in a study of this kind employing 13 variables found two significant factors: (1) experienced anxiety, with loadings mostly on verbal or written report of anxiety, and (2) degree of contact with reality, with loadings also on blood pressure. Factor analyzing 25 variables of different experimental status, H o l t z m a n and S i t t e r m a n (1956) tried to determine factors that were relevant to the adjustment to stress. Their five factors were: (1) rating measures, (2) perceptual measures, (3) stress test variables, (4) conditioning measures, and (5) MMPI measures. These factors apparently separate neatly the various types of measurement, grouping together all measurements of a kind, but fail to point out any psychologically meaningful dimensions either within one area of measurement or covering more than one such area.

In an analysis of a biographical inventory, psychiatric diagnosis and a multiple choice incomplete sentences test E v a n s (1955) found 3 factors and identified them as (1) a social status factor, (2) a manifest anxiety factor, and (3) inhibition and non-aggression.

R o s e n t h a l (1936) in a factor analysis of 54 variables (various types of measurement), found 9 factors which she identified as (1) anxiety (with loadings on the Taylor MAS as well as on measurement of C a t t e l l's UI 24), (2) social willingness (identified as similar to C a t t e l l's UI 20), (3) restraint-inhibition (somewhat similar to C a t t e l l's UI 17), (4) high nervous speed (matching C a t t e l l's UI 22), (5) dysthymia-hysteria (matching E y s e n c k's factor of the same dimension) (6) an autonomic function factor, (7) critical exactness (matched with C a t t e l l's UI 19), (8) hypomanic anxiety (somewhat similar to C a t t e l l's UI 18), (9) accurate realism (somewhat similar to C a t t e l l's UI 25).

Another large integrative study was conducted by M a r t i n (1958), using 28 variables including learning and motor tasks, intelligence tasks as well as 4 anxiety scores based on the Taylor MAS. He extracted 8 factors, of which only one could be interpreted as anxiety and he concludes that "individual difference of anxiety level accounted for a relatively small percentage of the variance of the obtained scores" (pg. 137). Repeated investigations of an integrated type have been made by E y s e n c k (1944, 1953, 1956, 1957) and C a t t e l l (1945, 1957, 1958, 1960, 1961). Already in 1944 E y s e n c k reported his major finding of a "general" factor "N" (representing "integration" "adjustment" or "emotional stability") as well as two bipolar factors: (1) "sthenic"-asthenic" or "extravert-introvert", and (2) "dysthymic-hysterical". The general factor - later called a neuroticism factor - and the bipolar extraversion-introversion factor have repeatedly been identified in other studies by E y s e n c k and

a number of his students (H i . n e i w e i t, D e s a i and P e t r i e, 1946, etc.) In his later studies E y s e n c k has, exept for adding a psychoticism factor, tried to explain neurotic phenomena on the basis of these factors. Specifically, he found that hysteria can be placed at the extraverted end of the neuroticism dimension and anxiety on the opposite, the introverted end of the neuroticism factor (1957). In a recent study he found that the Maudsley Extraversion Score, the Cattell Extraversion score, the MMPI Pd score and the MMPI Hy score all load his extraversion factor, while the MMPI Pt score, the Maudsley Neuroticism Scale, the MMPI K scale and the Cattell Ite scale all load his neuroticism factor (E y s e n c k, 1960). E y s e n c k thus does not see anxiety as a factor in its own right, but rather as a composite of his two major factors. C a t t e l l on the other hand found that anxiety can be treated as a single factor (U.I.24) which in a reanalysis of 13 multivariate analyses with 814 variables he found well replicated (1958). He also found it to be independent of other factors such as "introversion" (U.I. 32), "neuroticism" (U.I. 23), "stress"(P-technique factor 4), "psychotic tendency" (U I. 25), "dependent sociability" (U.I. 20 and U.I. 28), "conscientiousness" (Factor G and U.I. 19) and "self reliance" (U.I. 35). His "anxiety factor" U.I. 24 is described as a factor of free, overt, introspectable anxiety. It correlates highly with his second order questionnaire and life data factor II named "anxiety vs. integration" (C a t t e l l, 1957) C a t t e l l felt at that time that U.I. 24 does not, however, cover certain aspects of anxiety, and that it may be necessary to postulate a second anxiety factor, namely a factor of "anxiety of independence" (pg. 304 and 306) as discussed by F r o m m (1941). He maintained at one point in his thinking that this

factor had already appeared in his factor U.I. 35 ("sturdy self reliance vs. high need appeal", C a t t e l l, 1958). Originally (1955) he had regarded U.I. 35 as representing a cholinergic or vagotonic factor, but in a recent publication (C a t t e l l and S c h e i e r, 1961) he prefers to call it "long-circuited dynamics" or "the total degree of long-circuiting behavior which the individual is sustaining" expressed in "accepting remote goals" (pg.325). It is no longer regarded as a second anxiety factor and since its meaning does not appear to be altogether clear and well established, no further outline of this factor will be attempted.

In contrast to E y s e n c k, C a t t e l l claims that his U.I. 24 anxiety factor does not correlate with E y s e n c k's neuroticism factor (1957, pg. 318). In a second order factor analysis of his primary factors C a t t e l l (1961, pg. 81) finds that U.I. 24 loads a second order factor "Tension to Achieve or Controlled Drive Tension Level", i.e. U.I. 24 does not contribute in this analysis to a general neuroticism factor. It may be mentioned here that U.I. 35 does not load this second order factor.

Reviewing the various factor analytic studies, one is confronted with a number of different theories, claiming that

a) anxiety is a single, independent factor
b) anxiety can be explained on the basis of two other bipolar factors and is not an independent factor
c) anxiety is part of a general maladjustment or personal discomfort or distress dimension and does not constitute an independent factor
d) anxiety splits up into four or more clusters which may or may not be called anxiety factors

e) factor analysis yields no anxiety factor at all, but only factors for each medium of investigation employed.

Whereas it is possible that d) and e) may be artefacts resulting from limited material or from inadequate factorization, a) and b) appear to involve an irreconcilable difference at least as the results of factorization are interpreted and discussed by the respective authors. Although some of the tests on which these two theories are based were almost identical, it may be possible that future investigations will be able to clarify this difference. Theory c) on the other hand, could possibly be reconciled with b), since the identity of the maladjustment factor with a neuroticism factor has not been disproved and this maladjustment factor was based on questionnaire data only.

For the factor analysis of the results of this study the following predictions were made:

1) Within the MMPI data, a general emotional maladjustment factor will be found, including loadings on the A scale and several other clinical scales of the MMPI.

2) Intelligence will be related to a number of variables, namely category test errors and time as well as time estimation measurements, forming a factor by itself.

3) All physiological measurements will show a positive interrelationship, forming a factor by themselves.

Beyond these three predictions no specific hypotheses in respect to the outcome of the factor analyses of the results were made. It was felt that in particular the evidence in respect to an anxiety factor was too contradictory to permit specific predictions beyond that of a general maladjustment MMPI factor. At the present stage

of research factor analyses of a large number of variables still must be considered exploratory in large parts until more satisfactory evidence is available to make specific predictions.

II. P r o c e d u r e

A) Subjects.

At the time of this study, all Ss were members of the German Bundeswehr regularly drafted for their one year service from all parts of West Germany. They were thus drawn from a group of presumably healthy, normal young men between the ages of 17 and 23 and constituted a fairly representative sample of that segment of the West German population. Testing was conducted in four different units located at Koblenz, Idar-Oberstein, Zweibrücken, and Lebach.

B) Group Testing.

Selection of Ss for the individual testing sessions was made on the basis of the results of group testing sessions in which 650 Ss participated. This testing was done in the morning between 9 a.m. and 1 p.m. in groups ranging from 12 to 85 Ss. Typically, the officer of the unit introduced the Es and left the room after one of the Es had explained the general scope of the study, and had assured Ss that their results would be treated anonymously and that participation was voluntary. In the first session, lasting about 2 hours, a group intellingence test was given first, followed by an anxiety scale. In the second session, given within one week of the first and lasting about 1 1/2 hours, the German version of the MMPI was given. A smaller number of Ss in two of the units were given a sociographic questionnaire[1] after the MMPI. At the

[1] "Soziometrische Test zur Erfassung informeller Gruppenstrukturen und die soziale Situation von Soldaten als Hintergrund ihrer Angstbereitschaft", mimeogr. copy. Forschungsstelle fuer Soziologie der Universitaet Koeln, 1962. Since this study was conducted independently by the Cologne sociologists, no further reference can be made at this time. The results of this study in relation to the results presented in this paper will, if published, be issued as a technical note.

beginning of the second session motivation for participation was stimulated by a few remarks of appreciation and praise.

The "Intelligenz-Struktur-Test" (IST) (A m t h a u e r, 1953) was used in a short version suggested by L i e n e r t and L u c h t m a n n (1958). The IST is a well standardized group intelligence test, originally consisting of 9 subtests. In this study only five subtests were used (Sentence completion measuring mostly judgment common sense, reality testing; Analogies measuring flexibility and exactness of thinking; Common Denominator, measuring abstraction and verbal abilities - S is requested to write the best fitting generic term for two words presented; Continuing Digit Rows, measuring inductive thinking in figures, abstract calculation abilities - S is requested to choose a figure which continues a logical sequence of figures, e.g. 4, 6, 10, 12, 16, 18...; Cubes, measuring spatial reasoning and Vorstellung - S is required to choose the cube out of five that is identical with the one presented if turned spatially).

The anxiety scale used in this study has appeared in a previous publication (S p r e e n, 1961 a). Briefly, it consists of items taken from three different scales purporting to measure anxiety (C a t t e l l, 1957, T a y l o r, 1953, W e l c h, 1956). These items were checked for adequacy of translation and revalidated against therapists' ratings of anxiety of two clinical groups and corrected for one-dimensionality of distribution.

The personality inventory administered in group testing, the MMPI, is well known (H a t h a w a y and M c K i n l e y, 1951). Its German adaptation was available in a preliminary version (S p r e e n,

1961 b, S p r e e n and S u n d b e r g, 1961) which was checked for adequacy of translation. The American scoring keys were employed for the three validity scales (L, F, and K) and ten standard scales (Hs, D, Hy, Pd, Mf, Pa, Pt, Sc, Ma, and Si) as the normative and revalidation studies on a German population were not yet completed. In the meantime, the analysis of results with the German version of the MMPI on various clinical and normal groups indicated that the validity of the MMPI scales will in general remain comparable to that of the American version of this test, although norms had to be altered slightly (S p r e e n, 1962).

C) Experimental Design and Assignment of Subjects.

Since it was intended to study both the effects of general anxiety level and of stress on the psychological functions listed before, a two-dimensional experimental design with four groups was appropriate for the individual testing:

	Stress Conditions	Non-Stress Conditions
High Anxiety	Group A	Group B
Low Anxiety	Group C	Group D

For the second part of the study (correlational and factor analysis), high and low anxiety groups were to be analyzed together. Plans for handling the stress conditions in the factor analysis were made dependent on the outcome of the analysis of variance. Two separate analysis would have to be carried out if stress and non-stress groups differ significantly on a number of the variables to be included in the analyses. A single factor analysis would by sufficient if no significant differences between stress and non-stress groups appear.

Of the 650 Ss tested in group testing, about 15% were lost for various reasons; (a) All Ss having an IQ of 79 or less on the intelligence test were excluded since it was likely that these Ss would have serious difficulties in following the tasks; (b) other Ss were lost because their particular units could not send them on the day of the second group testing or during the period allotted for the individual testing; (c) a few Ss refused participation or showed in their group test results that they were unable to follow instructions or gave invalid records for other reasons. Of the remaining 541 Ss about 60% were selected on the basis of the anxiety scale. They represented the upper and the lower 30% of the distribution of the total group, 146 "high anxiety" (HA) and 145 "low anxiety" (LA) Ss. The high and low anxious Ss were randomly assigned to the individual testing sessions and stress conditions at first, but after about half of the Ss were tested, an attempt was made to match the four experimental groups for intelligence, distribution of A score and time of day of individual testing. The mean IQ scores for each group may be compared in table 73 in the appendix of this paper. Table 2 shows the distribution of Ss in each of the four experimental groups according to hour of testing. The distribution of Ss according to A scores is presented in table 3. Table 4 contains the number of Ss examined at the four different places, corresponding to the order in which they were tested. It can be concluded that the experimental groups were reasonably well matched in all these respects.

T A B L E 2

No of Ss in each experimental group and time of individual testing sessions.

	HAs	LAs	HAns	LAns
8 a.m.	16	15	15	15
10 a.m.	16	15	16	16
total morning	32	30	31	31
1 p.m.	14	16	17	14
3 p.m.	15	14	12	15
5 p.m.	12	13	13	13
total afternoon	41	43	42	42

T A B L E 3

No. of Ss in the experimental groups by A score level.

A score range		Stress	Non-Stress
Low A	0 - 5	2	3
	6 - 10	13	13
	11 - 15	33	33
	16 - 18	25	25
High A	23 - 32	34	34
	33 - 37	19	20
	38 - 42	13	12
	43 and more	7	7

T A B L E 4

No. of Ss in the experimental groups by place of testing.

Place	HAs	LAs	HAns	LAns
Koblenz	16	20	19	22
Idar-Oberstein	31	27	34	27
Zweibrücken	16	13	11	17
Lebach/Saarbrücken	10	13	9	7

D) Individual Testing.

1. General Situation.

Individual testing was done in a fairly quiet room provided by the army units, usually situated in the headquarters building. The arrangement of the experimental room was identical in all places. Fig.1 and 2 (page 46) show the arrangement from E's side and from S's side respectively. Light from outside was totally excluded, the room being lighted only by a single 60 W bulb and small reading lights for E and S when required by the experiment.

All Ss were tested by the same E. Ss reported individually and were introduced into the experiment by E who explained that they were to participate in a general ability and attitude testing program. Further explanations and instructions throughout the individual testing differed for stress and non-stress conditions as described below. However, all Ss were reassured at the end of the session about their performance and about the anonymity of their individual results. They were permitted to ask questions about the general purpose of the study and warned not to talk with

FIG. 1: Experimental Room, Experimenter's Side

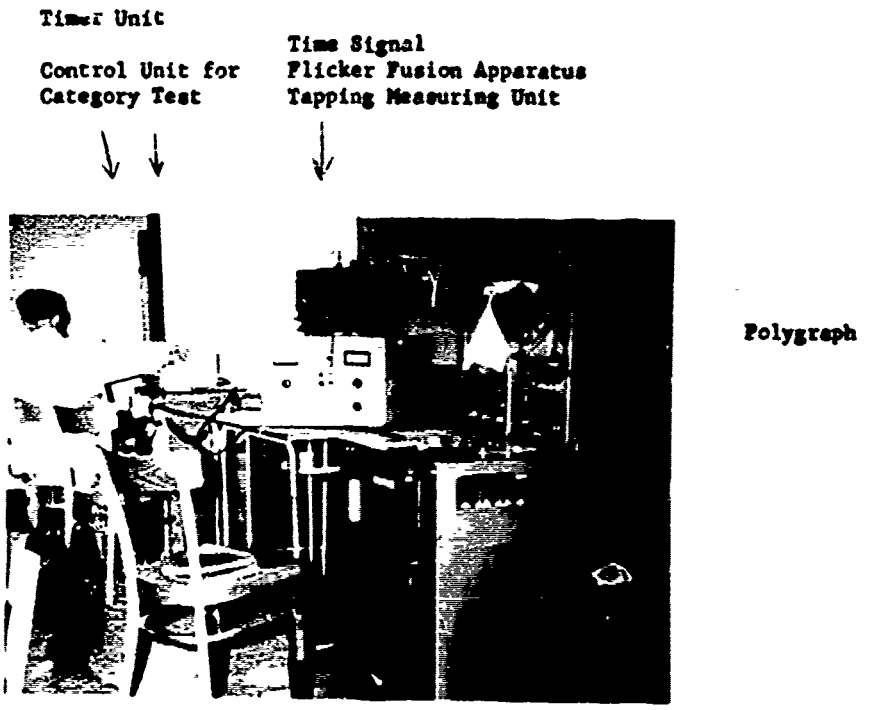
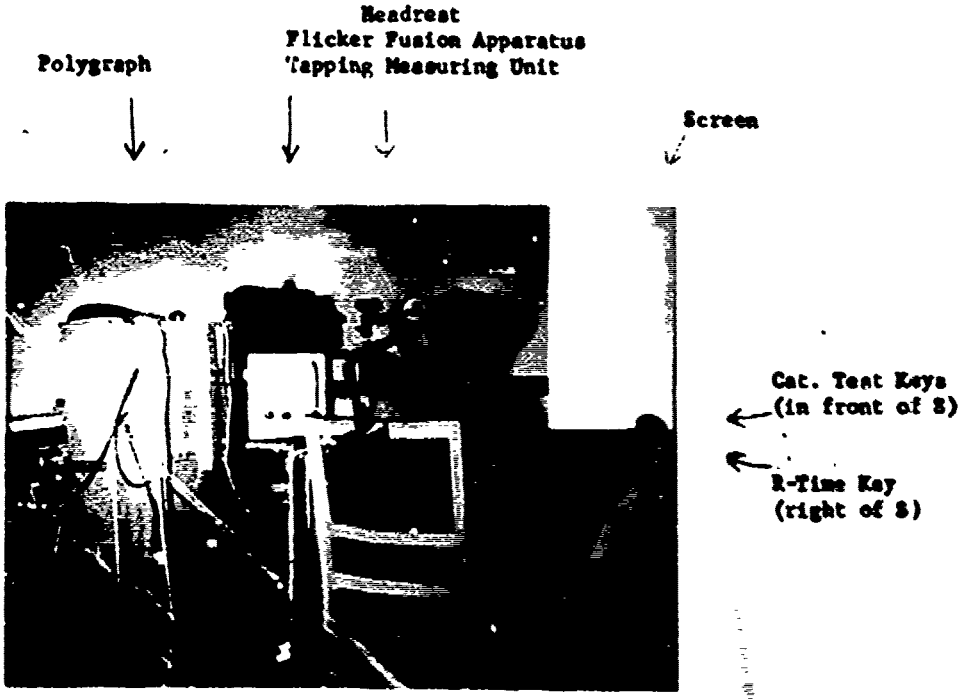


FIG. 2: Experimental Room, Subject's Side



other members of their unit before the end of testing program. Cooperation under these conditions was usually good, particularly since Ss liked to have a few hours off duty, and it was found that Ss usually had not been informed about the experiment by previous Ss.

2. General Stress Conditions.

In this study a fairly mild psychological stress was selected, mainly for practical reasons. A general stress situation is difficult to maintain over a period of 1 1/2 to 2 hours with varying tasks if stress is induced by threat or failure. Therefore, stress was mainly introduced by different instructions to stress and non-stress groups. It was intended that the non-stress groups should perform under conditions of a permissive atmosphere with no suggestions of failure, whereas stress groups should perform under conditions of a strict atmosphere in which both competitiveness and the suggestion of poor performance as well as apparatus stress were emphasized. The preliminary instructions for the two groups were as follows:

For Ss under non-stress conditions:

"As you have heard from Dr. S. and from Captain X., your unit commander, we are conducting a project here in which we are measuring a number of attitudes and abilities in soldiers of your age. The tasks are not exhausting and do not make demands on you that you cannot easily fulfill. For example, we will measure you blood pressure and have you do some simple tasks which will show us how fast you react something, how you judge pictures, and so on. This is somewhat similar to a driver's ability test. I am going to explain every task thoroughly to you. If you did not understand

something, ask me right away. We can talk about the whole investigation later at the end of this session. The results are only for a scientific study at the University of Saarbruecken and will not be reported to your unit."

For Ss under stress conditions:

"What's your name (E inspects papers from the group testing and wrinkles forehead questioningly). Oh, yes, here I have your results from the other day. We are going to make a few more investigations with you. I will explain to you what you have to do in detail. Sit down here and do not ask questions before the end of this session. We are comparing your results of the other day with those of other young men of your age. What you are going to do now is also to be compared to the results of a group of 19 - 22 year old men. We have also conducted an investigation with a group of 19 to 22 year old girls who gave excellent results. We will compare your results with that group, too."

In addition to these differing instructions, E tried to maintain a friendly, helpful and polite attitude during the non-stress situation. He did not answer to questions other than those that the understanding of instructions required but assured the S that he could discuss these questions at the end of the session. Under stress conditions, E tried to maintain a brusque commanding attitude. Differing instructions for each task will be given with the description of the task concerned.

3. Tasks.

The following description of procedure is presented in the sequence in which the tasks were actually administered. This order of pre-

sentation differs from that used in the preceding section and from that used in the result section. It is necessitated by the fact that often several variables were scored during performance of one and the same task.

Category-Test. In the original form of this test, devised by H a l s t e a d (1947), S is required to make a choice of one of four stimuli presented on a screen. The four stimuli typically contain three that are in some ways alike and S has to find the one that does not belong into this "category". Other but similar principles are used, all involving the finding of a "category" and a multiple-choice decision.

The stimulus material in this study was selected from the revised Halstead material (S i m m e l and C o u n t s, 1957). The selection, necessary because the time needed for the complete material was more than one hour, was made on the basis of a pilot study (partly evaluated by S c h m i d t, 1961). Criteria for selection were (a) that the material should not be too easy for the type of Ss tested in this study, and (b) that the correlation between the selected series and the total material should be reasonably high for both decision time and errors. The selected series consisted of 3 slides of series I and II, used as the training series, the complete series IV (series II in this study), 10 pictures of series V (nos. 1-4 and 18-23), and 30 pictures of series VI (nos. 7-10 and 15-40), used as series III in this study.

In the pilot study, the selected material had a correlation of .66 ($p < .02$) for errors and of .70 ($p < .02$) for decision time with the complete test. Also, a correlation of .68 was found between the selected series and the score on an anxiety scale.

In addition to the above series, the following pictures were selected and given in this sequence to Ss under stress-conditions before the experiment proper: Series III, nos. 29, 30, 27, 28, 21, 36, 37, 39, 4, and 3. (Failure series). The material was projected on a screen at a distance of 3.20 m from the S with a Leitz automatic projector, equipped with a 100 W bulb. Every change of a slide closed a contact starting a Bettendorf electric timer with 1/100 sec. accuracy. S had in front of him a small wooden box with four push-buttons. When one of the buttons was pressed the stopwatch was stopped. A green light mounted on top of the box indicated correct responses and a fairly loud buzzer built into the box indicated errors for the S. E sat sideways before the control unit which contained stopwatch, the push-button for changing slides, and a four button key for manual presetting of correct responses. E noted down time and errors for each individual picture on a scoring sheet for 80 (or, when stress series was included, 90) responses.

All Ss received the following instructions: "On this screen you will see some figures and drawings. Before you is a box with 4 buttons, corresponding to the numbers 1 to 4 from left to right. What you see on the screen corresponds in some way to the numbers 1 to 4. You are required to find out which number corresponds best to what you see and then to press the appropriate key. As you see the pictures, you will easily recognize what number corresponds to the figures. After you press the correct key, a green light on the box lights up. If you press the wrong one, a buzzer sounds. This way you will know at once whether your choice was correct or not. For each picture you may press only one button once. After you have

made your choice, we will go on. You can look at each picture thouroughly, but I want you to make your choice as fast as possible. We will first have a short practice period with a few pictures so that you have a better understanding of the task."

When uncertainties occurred during the training series the respective part of the instructions was repeated. After the training series, Ss under stress conditions received the following instructions:
"Now the task starts. It consists of three series. I will not announce, however, when a new series starts."
Ss were then presented with the failure series, for which only buzzer signals ("wrong") were given regardless of the choice of the S. After this series, E made the following remark:
"Be more careful. What you did so far was wrong."
Series II and III were then given under standard conditions.
For Ss under non-stress conditions E gave the following instructions after completion of the training series:
"This was fine so far (adding, if S had made errors on the training series, "people always make some errors.") Now we start with the task itself. It consists of two series. I will not announce, however, when a new series starts."
Series II and III were then given under standard procedure.

Polygraph Measurements during Viewing and Judging of Emotionally Toned Visual Stimuli.

This task consisted of a series of 45 pictures, projected on a screen, which the S was required to view and judge in terms of their stimulation value. Before and during the task a number of physiological measurements were made.

A Stoelting multichannel oscillograpy with four equipped channels and a time and events marker unit was used. A paper speed of 25 mm/sec. was found adequate. The four channels included a pneumograph channel (low pressure, Stoelting SA-212), a myograph channel (movements recorded mechanically and transformed via a photoelectric transducer SA-78 and an amplifier SA-65 on a galvanometer pen SA-97), a galvanograph channel (amplifier SA-70, galvanometer SA-216 with odometer scale for basic resistance level and adjustments), and a cardiograph channel (pneumatic, high pressure SA-212). The time and events marker unit (SA-200 plus SA-94) was set to record galvanometer sensitivity every 30 sec. on the galvanometer curve with a simultaneous events mark. By means of a separate 12 V circuit an automatic projector (Leitz, 100 W bulb) was connected in such a way that a double mark was made on the event marker curve at the time of each automatic slide change.

Stimulus material consisted of a number of pictures selected from a newspaper archive, a sample of cartoons, Rorschach plates, and TAT pictures. The newspaper pictures were first sorted by three psychologists into the following four categories (1) "Corpses" (including war scenes, atrocity pictures, accidents), (2) "Fire, accident, destruction" (similar to (1), but without persons), (3) "Court scenes" (a presiding judge, accused with counsel etc.), (4) "Gangs, police, riots" (most of them depicting policemen fighting or arresting rioting civilians). Category (5) consisted of Rorschach plates. Cartoons were similarly sorted into two categories designated as (6) "aggressive cartoons" (Steinberg, Cheval etc.), and (7) "macabre cartoons" (all by Ch. Adams). Category (8) consisted of TAT pictures, selected for anxiety-provoking content.

From the total stimulus material of nearly 100 pictures, 45 slides were selected on the basis of a pilot study for inclusion in this task. Criteria for selection were (1) adequate variability of judgments, (2) adequate variability of time needed for making judgments, (3) evidence of physiological reactions during the judgment of each picture, and (4) equal representation of all 8 categories. The one exception to the latter criterion was the Rorschach plates, all of which were included. Five pictures were included in each of the other categories, making a total of 45 slides to be presented to S. These were preceded by 3 introductory practice pictures and were presented in a permutating order.

S was seated on a chair with arm and head rests. A blood pressure measurement was taken first on the left arm. The deflated clap was left on the arm while the rest of the apparatus was fitted and adjusted. the pneumograph hose was fitted at medium level around the chest in standard fashion. The myograph lever was loosely fitted with a tape on the skin at the upper part of the trapezius muscle and held in position by the shirt collar of the S. In order to leave the right arm free for writing, the electrodes for the galvanograph recordings were fitted to the right and left big toes. Feet were placed on a foam rubber padding, toes were cleaned with washing gasoline and thinly smeared with electrode jelly. Stoelting finger silver electrodes with adjustable steel spring spanners were found best for this electrode position. In front of S was a small desk with the switch for the automatic slide changer, pen, and protocol sheet, placed in such a way that only minimal movements of the S's right hand were necessary throughout the experiment. The room was darkened except for a small shaded lamp, lighting only the recording

sheet on S's desk. E was seated behind the oscillograph for adjustment of apparatus, but was able to observe both S and the screen.

All Ss received the following instructions:

"I am going to show you a number of pictures on this screen. You are, first of all, requested to observe each picture carefully. On this sheet here you find numbers corresponding to the numbers of pictures that I am going to show you. You see three columns for each picture. You are to decide whether the picture shown to you is humorous, exciting or repellent to you. Of course, you will find some pictures more some moderately, and some very little humorous, or exciting, or repellent. You indicate this by writing a 1 for little, a 2 for moderately, and a 3 for very into the respective column. You find the meaning of the columns and the numbers listed here. Time is not important in this task. Please ask me now if anything is not clear. After you have seen the picture and made your entry, push this button for the next picture."

After this part of the instructions, E started the projector and showed the first (demonstration) picture, S made his rating and was corrected if necessary. The projector was then turned off and the following instructions, differing for stress and non-stress conditions were given

For Ss under non-stress conditions:

"At the same time, I am going to make some measurements of your breathing and your heart activity. There is no need to be afraid at all about this; these experiments have been made many times. We will leave this clap on the arm and if it should become a little tight, that is entirely harmless. I will also need your feet

(electrodes are adjusted). We will lay this on your back (myograph lever is adjusted). Please remain seated in a relaxed, comfortable and quiet position, leaning with the back to the chair. Do not move your left arm and keep your feet in the same position. Please do not speak as long as the pictures are shown. Now we will first sit a moment quietly so that you get familiar with this. Just relax. Do not keep your mind on anything particular. Just count from 1 to 200."

For Ss under stress-conditions:

"At the same time we will fix you to this appertus, which gives us some data about your body. I will now put these electrodes on your toes and then inflate the blood pressure clap. It may give you some pain. Try not to be blockheaded about the tasks and keep absolutely quiet throughout. Do not make any movements and keep your whole body except your writing arm in this position. Speaking is forbidden from now on. (And after adjustment of apparatus and resting period). In previous studies we have found that normal people find some of these pictures humorous, some exciting and some repellent. We will see what ratings you are going to make. Come on, push that button, the first picture."

Under both conditions Ss were required to sit quietly for a period of 2 min. During this resting period, all recordings were adjusted to S's basic level. Pneumograph, cardiograph, myograph and galvanograph recordings were made continuously during the resting period and the entire time of viewing and judging the slides.

Circles Made with Foot in One Minute.

Ss under non-stress conditions received the following instructions: "Let's do something else for a change. We are interested in how

many circles with one foot people of your age can make. So, please stand up, hold on here, lift the foot with which you are best, an' when I say go make circular movements as fast as possible. Are you ready? Go."

Ss under stress-conditions received the following instructions: "Get up, please. Lift one foot, the one with which you are most skillful. Hold on here. You are to make circular movements with this foot as fast as possible. But do not try to cheat by just going back and forth with the foot. I am going to observe and count only real circles. Ready. Go" and after completion of the task: "So far, we found much better results in people of your age." Ss rested one hand on a ha[illegible] at chest level. E gave start and stop signal, using a stopwatch, and counted the number of circles.

Operational Time Estimation. S was seated at small desk and a stopwatch was placed in front of him face down. Ss under non-stress conditions received the following instructions: "Now you can sit down again. I want you to estimate times. When you push this button here, the watch starts going. When you push it a second ti[illegible], it stops. Now I want you to try to stop it at a time of 10 seconds. Please do not count. Let the watch run as long as you think 10 seconds last. After you have stopped the watch, leave it lying there face down."

Ss under stress-conditions received the following instructions: "Sit down. When you press this button, the watch starts going. When you push a second time, it stops. You are to stop it now at exactly 10 seconds. Do not try to count and leave the watch face down when you are finished." E read the time after each estimate, reset the stopwatch and handed it back face down. Thus S never saw the accuracy of his estimate. After the five estimates E

added for all non-stress Ss that their estimate was surprisingly accurate and for all stress Ss that their estimate was poor.

Flicker Fusion Frequency. A standard flicker fusion apparatus (von Bracken and Muehlfeld) was used with an 18 V .1 amp. bulb under 15 V current. The apparatus had a round screen with a 10 mm diameter and measured interruptions by a precision speedometer (measuring error .1 to .2 hz) attached to the transmission of an electric motor. S viewed the screen in a totally darkened room at eye level from a distance of 95 cm. Motor noise was not audible from this distance.

No differing instructions were given under stress or non-stress conditions.

Apparatus was first set at 25 interruptions/sec. The following instructions were then given:

"Put your head in a relaxed position backward against the head rest. Do not move your head. Now look at this spot here (flicker screen). When you press this button on the remote control, the light on this spot comes on. Try it out. You see now a flickering light. Now press the button again. The light goes off."

Apparatus was then set at 55 interruptions/sec.

"Now press again. You see now a steady light without flicker. Now look at the screen only and watch. As soon as the light definitely starts to flicker, press the button."

E changed the speed now from 55 interruptions/sec. downward at the rate of 1 unit per second. For controlling E's speed of adjusting the appartus a metronome was kept running at one beat per second. Four descending and four ascending trials were made. Critical speeds were entered into a scoring sheet by E. Reading accuracy was about .5 units.

Autokinetic Movement. A small wooden box containing a 220 V red Osram glow bulb with an opening of 1 mm ∅ was placed slightly below S's eye level in front of the projection screen at a distance of 3.20 m from S. Generally, this box was not noticed by Ss before this part of the experiment. Light adaptation of all Ss could be assumed to be about the same since this experiment was performed after about 1 hour of previous testing under the same conditions. The room was totally darkened.

S was seated at a small desk and received the following instructions under stress and non-stress conditions:

In a moment, after I have switched the lights off, you will see a small red light. Look steadily at this light and at nothing else. Do not move in your chair and lean your head backward against the head rest. As soon as you notice a movement of the light which is more than 5 cm, tell me. Follow the movement and estimate as exactly as possible how long the movement is. Tell me right away what movements you see."

E was standing near the screen during the experiment so that Ss might assume that he was actually moving the light, although this was never stated. E switched the room light off and turned the AM light on, at the same time starting a stopwatch and a three-minute timer. As soon as S reported the first movement, E stopped the watch. E counted the number of direction changes and the size of the movement as they were reported spontaneously by S. After the three-minute timer signal, E turned the AM light off. S, then still in darkness, was asked to report the total length of AM observed, the number of direction changes, whether or not he had seen a three dimensional movement, and whether the movement

went round, in bows or circles or straight.[1] All data were noted down by E after the room lights had been switched on again.

Tachistoscopic Recognition Threshold for Emotionally Stimulating and Neutral Words. The optimal arrangement found during pretesting consisted of an automatic slide projector (Leitz) with a 100 W bulb, a Compur shutter, and an opening of 22. In a darkened room, the screen was lighted by a 100 W bulb, mounted below the screen and pointing at it at a 45° angle. A round white cardboard of 2.5 cm ∅ was hung at the center of the screen.

The stimulus material used during pretesting consisted of 12 emotionally stimulating ("taboo") and 13 neutral words of equal number of letters. Corresponding "taboo" and neutral words contained almost identical letters and were assumed to be of equal familiarity to Ss. From this series eight "taboo" and eight neutral words were selected on the basis of the pilot study results, and an introductory demonstration word was added. The following words were used in this random sequence:

Abend, kochen, picken, filmen, kalken, Tampax, Froesch, pissen, Fromms, kacken, farmen, Talent, Brueste, Buerger, kotzen, funken, ficken.

Words were drawn with india ink on white cardboard and reproduced photographically on slides.

S was placed in front of a small desk and given a recording sheet and pencil. All Ss received the following instructions: "I am going to show you some words on the screen. You will see

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1 Questions were asked in darkness since during the pilot study some Ss tended to change their statements after the room was lighted again and they had looked at the stimulus box.

them exactly at the center of the screen where the little disc is hanging. The words will be shown only a very short moment and maybe you will not recognize them exactly. There will be 11 words altogether, and every word will be shown 6 times. Now, I want you to write down anything that you have seen, even single letters. I am going to count "two, three" and I want you to concentrate on the screen. Please write down everything, even fragments." The demonstration word "Abend" was then presented and instructions repeated, if necessary, and the recording of the S on the recording sheet was checked. S was again instructed to write down any fragments whether they made sense or not.

E set the shutter speed at exposed words only when S had finished writing and was looking at screen. Six exposures were given to all Ss with increasing durations as follows: 1) 1/100, 2) 1/100, 3) 1/50, 4) 1/50, 5) 1/25, 6) 1/25 sec.

Ss under non-stress conditions were asked once during the presentation of each word (when E was sure that S was noting down something): "Did you see something?" and upon an affirmative response "Fine, please write it down just the way you saw it." For Ss under stress conditions following the first part of the instructions, S was told: "Keep your eyes open and try to see something." Once during the presentation of each word these Ss were told: "Write down everything."

Simple Reaction Time. An electric timer (Bettendorff, Brussels, T 48) in modified form (Hosmann, 1955) with auditory signals was used. The stimulus was a medium loud buzzer standing about 50 cm left in front of S. S responded by means of a telegraph key. Two cycles of 30 and 40 trials respectively were given by means of an

automatic signalling device. The first cycle was irregularly spaced, the second cycle was spaced at 7.5 sec. intervals. Each cycle lasted 5 min., with the pause between cycles lasting only a few seconds.

Ss under non-stress conditions were instructed as follows:

"In the next task you will try to respond as fast as possible to a signal. When you hear this signal you press this lever as fast as possible. Speed is of importance. Please do not press before you hear the signal, because that makes your results invalid. We will make a tryout now and I'll tell you when it really starts."

Ss under stress conditions were instructed as follows:

"If you want to drive a car,[1] you have to be able to react fast. In the next task we will find out how fast you can respond to a signal. When you hear the signal, press this lever as fast as possible. Speed is of importance. Do not try to press the lever before the signal in order to achieve better results. I can control that here exactly and your results will then be useless. We will make a short tryout now."

After completion of the first cycle Ss under non-stress conditions were told: "That was good. Now we continue," and Ss under stress conditions were told: "Now try to get a little better results than you have given so far."

E sat behind timer unit, starting the cycles and noting down the time for each trial with an accuracy of 5/100 sec. (Timer hand showed an accuracy of 1/100 sec.).

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[1] It should be pointed out here that Ss usually did not hold a drivers license but were most eager to use the opportunity to get one provided by the army units during the second part of their military service.

Tapping and Steadiness Task with Simultaneous Tapping. The tapping and registering units were new constructions made according to suggestions by E. B o e s c h and G. E c k a r t (K r a e m e l, 1961). The apparatus permits simultaneous readings of pressure and speed of tapping cumulated over a minimum of 3 seconds, as well as continuous tracings of both measures by means of an additional oscillograph. Voltmeters registering speed and pressure of tapping can, if necessary, be readjusted by means of a standardization unit contained in the apparatus which automatically produces tapping speeds at intervals of 2, 4, 6, and 8 hz as well as certain steps of pressure. In addition to the continuous tracings and readings, the absolute number of taps is registered by an electromagnetic counter (90 V. 50 hz.). In this experiment, a Stoelting multichannel oscillograph was used for continuous tracings. Unfortunately, only one amplifier unit (SA-65 with pen SA-97) was adaptable for this purpose; it was used for tracings of the number of taps during the experiment, whereas pressure had to be read from the voltmeter and written down by E.

The apparatus for the steadiness task consisted of a pneumatic system which had a rubber ball at one end. Pressure on this ball expanded a cylinder on the other end which by means of a transmission moved a pointer along a scale, visible to S. The pneumatic system was also connected with the low pressure pen (SA-212) of the oscillograph for continuous tracing of the pressure exerted on the ball. S's task was to press the rubber ball steadily enough to keep the pointer at zero position for a given interval.

S was placed in front of a small desk with a tapping key fixed at the opposite end of it. For the first part of the experiment (tapping only) the following instructions were given to all Ss:

"At this end of the teble you see a tapping key. Put your right arm across the table so that you can press the key with your forefinger. Put your palm on the table. I want you to tap for a while on this key as fast as possible. You can try it out for a moment. Start when I say go and tap until I say stop. Go! (and after the first trial) Now, we will do the same thing with the left forefinger."

Altogether 6 trials were made in this sequence: 10 sec. right, 10 sec. left, 1 min. right, 1 min. left, 10 sec. right, 10 sec. left. After each trial E said for Ss under non-stress conditions "Good". No remarks were made for Ss under stress conditions.

E recorded the maximum pressure reached during the 10 sec. trials and the maximum pressure reached during the first, second, third and last 15 sec. of each 1 min. trial. In addition, the actual number of taps on the counter were read and noted down for each trial.

After the six tapping trials, the following instructions were given to all Ss:

"Here you have a rubber ball; over there is a pointer. When you press this ball slightly, the pointer will move. You are to press the ball until the pointer is at zero position and to keep it exactly there for a while. Start when I say go. Go!"

One trial of one minute duration was made for each hand. Following this, the following instructions were given to all Ss:

"Now we will do the same thing again with your right hand. However, at the same time you will tap on this key in the same way as you did before with your left hand. Tap the key as fast as possible but be sure that the pointer stays at zero position at the same time."

Subsequently, the experiment was repeated with hands reversed, each trial lasting for 1 min.

Readings were made in the same way as in the separate tapping and steadiness tasks. After completion of the tasks, S was interviewed in order to determine the dominant hand.

Time Estimation from Memory. Immediately following the tapping trials (i.e. before the steadiness task was introduced), S was asked how long he estimated that the very last trial (10 sec. left hand) had taken, and told to make his estimate in seconds as exactly as possible. After this, S was asked how long he estimated the preceding "long" trial to be (referring to the 1 min. trial[1]). S noted down both estimates in seconds.

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[1]Referring the S to the 'long' trial was more unequivocal than asking for an estimate of the "trial before last" and necessary to avoid confusion. Moreover, the difference between the two trials was obvious to all Ss. So that no particular suggestion by this form of question was to be feared.

III. Results I: Group Comparison of Individual Variables.

The typical variable in this study was a single variable analyzed over treatment (stress-non-stress) x level (high and low anxiety), i.e., Lindquist's treatment x level design with a df of (2-1) + (2-1) = 2 could be employed (1953). However, in a few variables, an additional within subject dimension was analysed (e.g., five intelligence subtests) and Lindquist's type III design was employed[1]. Two other analyses involved repetition of an experiment which can be more adequately analyzed by Lindquist's type VI design.[2] Firally, for a few nonscalable data, a chi^2-test was carried out, and for some ordinal data the non-parametric Kruskal-Wallis one way analysis of variance was used (Siegel, 1956). Analyses of variance were carried out on an IBM 650 computer with programs following closely the procedures suggested by Lindquist. The following list describes the scoring of data made for the purpose of analysis for each variable and indicates the statistical tests employed. Where transformations were necessary, these will be listed.[3]

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[1] For technical reasons, some of the type III design analyses had to be carried out by 4 repetitions of the A x S design with anxiety or stress held constant repectively. The results of this procedure are, of course, essentially the same as with the type III design analysis.

[2] These analyses were carried out by four repetitions of the type VI design with anxiety or stress held constant respectively since the analysis of a third dimension (right or left hand) was desirable.

[3] All data were listed and tabulated for analysis of normality of distribution. The larger part of the data had an acceptably normal distribution. A few other variables were successfully normalized by transformations.

In addition, B a r t l e t t's test of homogeneity of variance was performed on each variable (after transformations) to be analyzed by variance analysis. These were all found to be satisfactory.

The following list is in the order given in table 1. (This order will also be used in the presentation of results):

A Physiological Variables

1 Galvanic Skin Conductance, basic resting level: Last odometer readings of the resting curve after adjustment to individual level, transformed into microamperes (odometer readings had been checked with a potentiometer). Further transformation into square roots for normalization of distribution. Analysis of variance, treatment x level design.

2 Conductance Level Type, rising or constant: A few Ss were found to show a continuous rise of conductance level throughout the experiment proper, making constant adjustments of basic conductance level necessary. Two independent raters checked each record for this phenomenon. Chi^2 analysis.

3 Systolic Blood Pressure: Measurement directly recorded and analyzed. Analysis of variance, treatment x level design.

4 Diastolic Blood Pressure: Measurement directly recorded and analyzed. Analysis of variance, treatment x level design.

5 Pulse Pressure: Diastolic blood pressure subtracted from systolic blood pressure. Analysis of variance, treatment x level design.

B Psychophysiological Variables

6 Galvanic Skin Reaction to Emotionally Toned Stimuli: Reactions to each individual picture were judged independently by two raters experienced in oscillograph evaluation. For this purpose, all recordings were put into random order and both raters judged

only galvanograph reactions, using a mask to cover the other recordings as well as to eliminate the recordings made during the 2 second period immediately before and the 2 second period immediately after the change of a picture because of possible side effects during these periods. Since inter-rater agreement was found to be very high (approx. 95 %), ratings of both raters were summed over categories. This permits a maximum score of 10 for each category; scores for category V (10 pictures) were divided by 2. Difficulties were encountered in some Ss' records when total judgment time for a picture was less than 6 sec. and thus could not be rated. To insure comparability of results, the sum for each category of pictures was corrected by adding an average from the rest of the pictures of that category for each picture that could not be rated. Analysis of Variance, type III design.

7 Pneumograph Reactions to Emotionally Toned Visual Stimuli: Number of reactions, summed for each category of pictures as described for variable 6. Analysis of variance, type III design.

8 Cardiograph Reactions to Emotionally Toned Visual Stimuli: Number of reactions, summed for each category of pictures as described for variable 6. Analysis of variance, type III design.

9 Myograph Reactions to Emotionally Toned Visual Stimuli: Number of reactions, summed for each category of pictures as described for variable 6. Analysis of variance, type III design.

C Simple Behavioral Functions

Motor

10 Tapping Pressure: Sum of 6 voltmeter readings for each hand (1 on each of two 10 sec. trials, 4 on the one minute trial). Standardized voltmeter readings reached from 0 to 6 and were

read with .5 units accuracy. Analysis of variance, 4 repetitions of type III design.

11 Tapping Speed; 10 sec. trials: Number of taps for the two 10 sec. trials for each hand. Analysis of variance, 4 repetitions of type VI design for anxiety, stress, dominant-non-dominant hand, first-last trial.

12 Tapping Speed; 1 min. trials: Number of taps for one one-minute trial for each hand and one one-minute trial for each hand with simultaneous task (steadiness, tremorgraph). Analysis of variance, 4 repetitions of type VI design for anxiety, stress, dominant-non-dominant hand, tapping alone and with simultaneous task.

13 Simple Reaction Time: Time for all 30 regularly spaced trials and for all 30 irregularly spaced trials was summed separately in 1/100 of a second. Analysis of variance, 4 repetitions of type III design for anxiety, stress, regular-irregular.

14 Simultaneous Task (Steadiness task with simultaneous tapping): Steadiness tracing curves of oscillograph for dominant and non-dominant hand were separately evaluated by comparing the curve performed without simultaneous tapping with the one with simultaneous tapping. Various analytic procedures were tried. The one finally used was the fitting of a strip of millimeter paper over the first curve (steadiness only) so that it was completely covered; the same strip was then fitted over the center of the second curve (with simultaneous tapping) after graphic determination of the center line. The length of that part of the second curve that was not entirely covered was counted in mm. The result is a difference score between the two curves directly expressing the amount of steadiness loss while tapping is performed simultaneously. Analysis of variance,

4 repetitions of type III design for anxiety, stress, dominant-nondominant hand.

15 Legcircling: Number of circles made in one minute. Analysis of variance, treatment x level design.

Perceptual

16 Autokinetic Movement; time to report of first movement: Time in seconds, transformed into reciprocals for normalization and multiplied by 10,000. Analysis of variance, treatment x level design.

17 Autokinetic Movement; extent of movement: Total estimated length in cm reported during 3 minutes. Analysis of variance, treatment x level design.

18 Autokinetic Movement; number of direction changes: Number of direction changes reported during 3 minutes trial, transformed into reciprocals for normalization and multiplied by 100. Analysis of variance, treatment x level design.

19 Autokinetic Movement; type of movement, circular or straight: Scored as 1 for Ss who reported circular movements of any kind, 0 for those who did not. Chi^2 test.

20 Autokinetic Movement; two or three-dimensional: Scored as 1 for Ss who reported three-dimensional movements, 0 for those who did not. Chi^2 test.

21 Flicker Fusion Frequency; mean frequency over series of trials: Sum of 5 ascending trials, sum of 5 descending trials. Analysis of variance, 4 repetitions of type III design for anxiety, stress, ascending-descending.

22 Flicker Fusion Frequency; variability score: Difference between highest and lowest score on ascending trials plus difference between highest and lowest score on descending trials. Analysis

of variance, treatment x level design.

D _ Complex Behavioral Functions.

23 Operational Time Estimation; sum over trials: Sum of estimates over five trials. Analysis of variance, treatment x level design.

24 Operational Time Estimation; change from first to last trial: Estimate for trial 1 minus estimate for trial 5 plus constant of 20. Analysis of variance, treatment x level design.

25 Time Estimation from Memory; 10 sec. trial: Time estimation for 10 sec. of tapping. Analysis of variance, treatment x level design.

26 Time Estimation from Memory; 1 min. trial: Time estimation for 1 min. of tapping. Analysis of variance, treatment x level design.

27 Speed of Multiple Choice Decision Making; series I: Time summed over 10 trials of first series, transformed into reciprocals and multiplied by 10,000. Analysis of variance, treatment x level design.

28 Speed of Multiple Choice Decision Making; series II and III: Time summed separately over series II and III for first 30 trials of each series. Analysis of variance, 4 repetitions of type III design for anxiety, stress, second and third series.

29 Errors in Multiple Choice Decision Making; series I: Number of errors on first series. Analysis of variance, treatment x level design.

30 Errors in Multiple Choice Decision Making; series II and III: Errors summed separately over series II and III for first 30 trials of each series. Analysis of variance, 4 repetitions of type III design for anxiety, stress, second and third series.

31 Tachistoscopic Recognition Threshold for Emotionally Stimulating and Neutral Words: A key was placed over the recording sheet, exposing all "taboo" or all neutral words respectively. For

each word, the score corresponded to the number of exposures of increasing length needed for correct recognition. Scores were summed for all 8 "taboo" and all 8 neutral words. Analysis of variance, 4 repetitions of type III design for anxiety, stress and neutral-taboo words.

32 Length of Observation of Emotionally Toned Visual Stimuli: Time spent observing emotionally stimulating pictures in half-seconds, summed over the five pictures of each category. Time for the 10 pictures of category V was divided by two in order to make it comparable to the 5 pictures of the other categories. Analysis of variance, 4 repetitions of A x S design for anxiety, stress, and categories of pictures.

33 Ratings of Emotionally Toned Visual Stimuli; "shockers" judged repellent: Number of pictures of categories I, II, and III rated as repellent. Kruskal-Wallis one way analysis of variance for high and low anxiety.

34 Ratings of Emotionally Stimulating Pictures; "repellent score" for "shockers": Score for mildly, moderately or strongly repellent (1, 2, or 3) summed for all pictures of categories I, II, and III. Kruskal-Wallis one way analysis of variance for high and low anxiety.

35 Ratings of Emotionally Stimulating Pictures; "cartoons" judged humorous: Number of pictures of categories VI and VII rated as humorous. Kruskal-Wallis one way analysis of variance for high and low anxiety.

36 Ratings of Emotionally Stimulating Pictures; "humorous score" for cartoons: Score for mildly, moderately or strongly humorous (1, 2, or 3) summed for all pictures of categories VI and VII. Kruskal-Wallis one way analysis of variance for high and low anxiety.

37a Ratings of Emotionally Stimulating Pictures; Rorschach plates judged repellent: Number of pictures of category V rated as repellent. Kruskal-Wallis one way analysis of variance for high and low anxiety.

37b Ratings of Emotionally Stimulating Pictures; "repellent score" for Rorschach plates: Score for mildly, moderately, or strongly repellent (1, 2, or 3), summed for all pictures of category V. Kruskal-Wallis one way analysis of variance for high and low anxiety.

38 Ratings of Emotionally Stimulating Pictures; overall judgment score: Score for mild, moderate, or strong judgments (1, 2, or 3), summed over all pictures and all three modalities of judgment. Kruskal-Wallis one way analysis of variance for high and low anxiety.

39 MAPI; time: Since the MAPI was given as a group test, time of completion was noted down on the answer sheet for all Ss and later calculated in min. Analysis of variance, one way design.

40-44 Intelligence Test Scores: Raw scores for each of the five subtests were converted into standard scores by means of conversion tables (supplied with the test). Analysis of variance, four repetitions of type III design for anxiety, stress, and subtests.

45-57 MAPI: validity and standard scales: Answer sheets were evaluated by means of the standard keys supplied with the US edition of the test. Where applicable, parts of K were added to the raw scores of standard scales. Analysis of variance, one way design.

All results of analyses of individual variables are presented in detail in tables 5 to 77 in the appendix. Due to the large number of variance analyses made only those significant at or beyond the .01 level can be considered for interpretation. Only these will be

reported in the summary of results which follows.

A Physiological Variables.

Tables 5 to 13 give the results for the physiological variables (Galvanic skin conductance, systolic and diastolic blood pressure, pulse pressure). No significant differences between groups were found for any variable although for galvanic skin conductance differences for high and low anxious groups were in the predicted direction. No significant results appear in the chi^2 test of the exploratory variable, conductance level type rising or constant.

B Psychophysiological Variables.

Tables 14 to 21 contain the results for the psychophysiological variables (Physiological reactions during viewing and rating of emotionally toned pictures). Highly significant results were found between categories of pictures for all four physiological measurements. The overall mean number of reactions for each category may be examined in tables 14, 16, 18, and 20. It may be seen that picture categories V, VII and, to some extent, VI and VIII tended to produce more reactions, although this varies slightly for each measurement. The statistical significance of differences between each of these categories is, of course, not established by this analysis. No main effects were found for anxiety or stress for any of the variables, although differences between means for anxiety tend to lie in the predicted direction.

An unexpected result is the interaction between anxiety and stress, significant at the .01 level, for both pneumograph and cardiograph reactions, indicating that high anxiety Ss under stress and low anxiety Ss under non-stress conditions had the lowest number of

reactions on both measures. Results on galvanograph and myograph measurements lie in the same directions, although the difference is not significant.

C Simple Behavioral Functions:

Motor (Tapping pressure and speed, reaction time, simultaneous task, legcircling): Results of these analyses are presented in tables 22 to 33. For none of these variables was a main effect of anxiety level found. For the stress dimension, only one analysis showed a significant result: Ss under non-stress conditions made more circles with leg than Ss under stress conditions, significant at the .01 level.

For the tapping and steadiness (simultaneous) task, comparisons were made of the performance with dominant and non-dominant hand. The results of these comparisons were all highly significant ($p < .001$). Although not directly related to the purpose of this study, the following results may be helpful in further work on this type of performance. Tapping pressure for all groups was consistently higher for the non-dominant hand; whereas number of taps, during short and long trials, was for all groups consistently higher for the dominant hand. This latter result held up also when Ss were required to perform a steadiness task simultaneously with the other hand. The number of taps achieved on the first trial was consistently higher than for the last trial for both hands ($p < .001$). When the steadiness task was performed simultaneously with the other hand, the number of taps increased consistently in all experiments ($p < .001$). Hand-steadiness, measured while tapping with the other hand, was consistently worse for the dominant hand, i.e., a greater loss of steadiness was shown for the dominant

than for the non-dominant hand.

An interaction effect of anxiety and the difference between dominant and non-dominant hand appears on the steadiness task in one out of four analyses. One stress/dominant-non-dominant interaction also appears on this task.

The results on simple reaction time, presented in table 28 and 29, indicate no significant effects of anxiety or stress. The difference between regularly and irregularly spaced trials is highly significant in all four analyses conducted, with regularly spaced trials producing shorter reaction times.

Perceptual (Autokinetic movement, flicker fusion): Results for these variables are reported in tables 34 to 45. In none of these analyses does the anxiety or stress effect reach an acceptable level of significance. For flicker fusion frequency, the difference between ascending and descending trials is significant in all analyses at the .001 level of confidence, i.e. FFF on ascending trials is lower than on descending trials.

D Complex Behavioral Functions:

Results for these variables (time estimation, multiple choice decision making, tachistoscopic recognition time, length of observation and ratings of emotionally toned pictures, time for completing questionnaire) are presented in tables 46 to 73. They will be considered individually.

In none of the three time estimation analyses (tables 46 to 53) did the anxiety or stress effect reach an acceptable level of significance. As a result relevant to time estimation in general, it was observed that for all Ss operational estimates tended to become higher (i.e.,

more accurate) in the course of five trials.

Time and error scores on the adaptation of Halstead's category test for series I, II, and III did not show influences of anxiety or stress at an acceptable level of significance. For all groups and for both time and error scores, the difference between series was significant, i.e. Ss worked faster and made fewer errors on series III as compared to series II.

The difference between recognition thresholds for emotionally stimulating and neutral words was highly significant ($p < .001$) in the predicted direction, i.e., the threshold was higher for emotionally stimulating words. However, the effects of anxiety or stress were not significant although the observed differences between groups lie in the predicted direction, i.e., higher for the high anxiety groups and higher for stress conditions within anxiety groups.

Viewing time for emotionally toned pictures (tables 64 and 65) shows a highly significant difference between categories of pictures ($p < .001$). Viewing time for categories V and VIII (Rorschach and TAT plates) were - in accord with the prediction - among the longest; however, viewing time for pictures of category VII (macabre cartoons) exceeds even those for categories V and VIII in all groups. Lowest viewing times were found for categories XV ("gangs, police, riots"), VI ("aggressive cartoons"), II ("fire, accident, destruction"), III ("court scenes") and I ("corpses"), in that order. Although this result in general lies in the expected direction, the consistent difference between the two categories of cartoons (categories VI and VII) is unexpected.

No main effects of anxiety and stress were found. Interaction between anxiety level and categories of pictures and between stress and categories also did not reach an acceptable level of significance. No stress-anxiety-categories interaction was found.

In the analysis of picture ratings (table 66 to 71), no effect of anxiety was found for the number of shocking pictures judged repellent or for the strength of these ratings. On the cartoons, high anxiety Ss made more humerous ratings as predicted ($p < .01$), but contrary to prediction these ratings were weaker than those made by the low anxiety group ($p < .001$). On the Rorschach plates, high anxiety Ss found less items repellent than low anxiety Ss ($p < .01$). The strength of repellent ratings for Rorschach plates was not significantly different for the two groups. Finally, the overall strength of ratings for all pictures was stronger for the high anxiety Ss as predicted ($p < .01$).

The time required to complete personality questionnaire (table 72 and 73) showed no significant difference between high and low anxiety groups.

E Test Data (Intelligence test subtests):

The overall result on the intelligence test (var. 40-44, table 74 and 75) indicates that no serious differences between high and low anxious and between stress and non-stress groups in respect to general intelligence level exists. This confirms that the matching of groups of Ss for intelligence was successful. Differences between subtests were highly significant; however, this difference was in no way related to anxiety level, since no significant interaction was found.

F Personality questionnaire data. (MMPI):

All standard MMPI clinical scales with the exception of the Hy scale show the predicted highly significant positive relationship with anxiety level. For Hy, the difference between high and low anxious groups was in the predicted direction, but did not reach an acceptable level of significance. For K and F, differences between high and low anxiety groups were in the opposite direction as predicted, i.e., High anxious Ss showed low K and F scores. In addition, Ss with high anxiety scores had significantly lower scores on the L scale ($p < .001$), although this result was not predicted.

A synopsis of all results on individual variables is given in the table on page 80 and 81 for a more convenient survey of the detailed results in the appendix (table 5-77).

IV. Discussion of Results of Individual Variables

It is obvious that the results in respect to the main sources of variance under study, i.e. anxiety level and stress, are disappointing. In short, only 15 out of 36 hypotheses concerning anxiety level, and only one out of 14 hypotheses concerning stress could be confirmed by statistical analysis. It seems advisable therefore, to discuss all nonsignificant results for the individual variables in toto and only the significant results individually. Mention will also be made of some additional analyses not directly relevant to the main topic of this paper.

A. Anxiety Level.

It will be recalled that most of the tasks were selected because there was some evidence to suggest that they were influenced by anxiety level and/or stress, although this evidence was by no means conclusive. For other tasks the relationship with anxiety level had never been explored but it was felt that the inclusion of these experiments would provide a fairly comprehensive coverage of a larger number of psychological functions rather than of a single variable or a particular field. The results clearly demonstrate that anxiety level as measured in this study is not a relevant source of variance for most of the performances investigated. This statement must, of course, be limited to the population sampled in this research. It should also be remembered that this study deals with a normal population and employs an anxiety measurement for the general population; the results of this study, therefore, cannot be generalized to a pathological or very intense type of anxiety.

Synopsis of Results of Analyses of Individual Variables

	Variable	A	S	A x S
1	GSC, Resting Level			
2	GSC, Rising or Constant			
3	Systolic Blood Pressure			
4	Diastolic Blood Pressure			
5	Pulse Pressure			
6	GSR to Pictures			
7	Pneumograph to Pictures			.01
8	Cardiograph to Pictures			.01
9	Myograph Reactions to Pict.			
10	Tapping Pressure			
11	No. of Taps, 10 sec. trials			
12	No. of Taps, 1 min. trials			
13	Reaction Time			
14	Steadiness Task			
15	Legcircling		.01	
16	Aut. Movement, Time			
17	Aut. Movement, Length			
18	Aut. Movement, Dir. Changes			
19	Aut. Movement, Circular			
20	Aut. Movement, 3-dimensional			
21	FFF, sums	(.05)		
22	FFF, variability			
23	Time estim, op., sum			
24	Time Estim., op., variabil.			
25	Time Estim., memory, 10 sec.			
26	Time Estim., memory, 1 min.			
27	Categ. Test, Speed, ser. I			
28	Categ. Test, Speed, ser.II&III			
29	Categ. Test, Errors ser. I		(.05)	
30	Categ. Test, Errors, ser.II&III	(.05)	(.05)	
31	Tachistosc., Neutr.-Taboo			
32	Picture Judgement, Time		(.05)	
33	No. Shocking pict., judged repell			
34	Score for sh.pict.judged repell			
35	No. Cartoons judged humerous	.01		
36	Score for cartoons, judged hum.	.001		
37	No plates judged repellent	.01		
38	Overall judgement score	.01		
39	Time for MMPI			
40-44	Intellig. Test			
45	MMPI K	.001		
46	F	.001		
47	L	.001		
48	Hs	.001		
49	D	.001		
50	Hy			
51	Pd	.001		
52	Mf	.001		
53	Pa	.001		
54	Pt	.001		
55	Sc	.001		
56	Ma	.001		
57	Si	.001		

Synopsis of Results cont'd

Var. No	Additional Analyses	p	Interaction with Additional Analyses	
1				
2				
3				
4				
5				
6	Categories of Pictures	.001		
7	Categories of Pictures	.001		
8	Categories of Pictures	.001		
9	Categories of Pictures	.001		
10	Dom.-NDom Hand	.001	S x Dom.-NDom Hand	(.05)
11	Dom.-NDom Hand	.001	A x Dom.-NDom Hand	(.05)
	First-Last Trial	.001	S x First-Last Trial	(.05)
	DNDom.-FLast	(.05)		
12	Dom.-NDom Hand	.001		
	Trem.-TNTremorgr.	.001		
	DNDom.-TNTremorgr.	.001		
13	Reg.-Irreg.	.001	S x Rirreg.	(.05)
14	Dom.-NDom	.001	A x DNDom	(.01)
			S x DNDom	(.01)
15				
16				
17				
18				
19				
20				
21	Ascend.-Desc.	.001		
22				
23				
24				
25				
26				
27				
28	Series	.001	S x Series	(.05)
29				
30	Series	.001		
31	Neutr.-Taboo	.001		
32	Categories	.001		
33				
34				
35				
36				
37				
38				
39				
40-44	Subtests	.001		
45				
46				
47				
48				
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57				

Insofar as this study was a repetition of some earlier studies, contradicting the results of such studies, some differences between this and other studies should be pointed out:

(a) The number of Ss used in this study was considerably larger than in most of the earlier studies, which allows for a certain amount of confidence in the present results.

(b) The sample of Ss in this study was homogeneous with respect to age and sex, not homogeneous, however, with respect to education, professional training, intelligence level, and fields of interest. While this study still does not allow broader generalizations to all individuals, the population was more heterogeneous than that sampled in most previous studies. This reduces confidence that results on more limited populations can be generalized very far. It seems at least possible that the results demonstrating relationships between anxiety level and certain psychological functions are partially traceable to the homogeneous educational and interest background ("psychology freshmen") of the Ss used.

(c) Although the possibility exists that some of the results of the present study were nonsignificant because of differences in the measure of anxiety used, it should be pointed out that the scale employed here was very similar to the ones used in previous studies. As reported elsewhere (Spreen, 1961) the anxiety scale in this study consists almost entirely of items taken from three anxiety scales widely used in the literature. The reduction of the original item list was based on two checks of validity and one of homogeneity of item frequency distribution.

It is not surprising to note that whenever a significant influence of anxiety level was found, it was for variables of the motor check-

list, or questionnaire type. A number of factors probably contribute to this result:

(a) A considerable item overlap exists between MMPI scales, thus accounting for a slight positive correlation between scales which is a pure artefact. Some of the anxiety scale items were originally taken from the MMPI. The amount of this overlap between MMPI scales and anxiety scale has been checked. Although it accounts for a slight positive correlation between anxiety scale and MMPI scales, this overlap alone is probably not sufficient to account for the amount of relationship observed in this study. As the correlational analysis will show, this relationship holds up even after the overlap has been eliminated.

(b) An additional factor probably contributing to this relationship might be called "general maladjustment", resulting in a general elevation of scales for the more complaintive, unwell S and a general depression of scales for the well adjusted, uncomplaining and the not-willing-to-admit S. Although this effect can by various means be eliminated or corrected in the individual S's record, and although it usually does not invalidate the profile differences for any given S, it has to be expected that in an analysis of variance between anxiety scale and any given scale this effect would be present to an extent that could raise the relationship under study to a highly significant level.

For further clarification it would, first, appear necessary to employ the MMPI scales cleared of any inter-scale overlap (pure scales or "prime scales"). Second, a correlational analysis would appear to be of more value to describe these interrelationships. Third, it might be possible by the use of factor analysis to

investigate whether or not "general maladjustment" or complaintiveness is the only source of common variance or if other relationships show up which give more detailed information. This will be done in the second part of the results.

Turning now to the picture judgments, the hypotheses that anxious Ss find more of the "shocking" pictures repellent, and that these judgments of "repellent" are stronger than those of non-anxious Ss, are not borne out. The hypothesis that anxious Ss would judge more cartoons as humorous is confirmed at the .01 level of confidence, not, however, the hypothesis that these judgements would also be stronger. As a fact, the humorous judgments of cartoons are stronger for the non-anxious groups at a highly significant level ($p < .001$). In other words, anxious Ss more frequently judge cartoons as humorous than non-anxious Ss do, but these judgments are weaker, they tend to call them only mildly humorous. When all judgments of all categories are summed, the hypothesis that anxious Ss prefer the stronger judgments in general is confirmed at the .01 level of confidence. Contrary to prediction, it was found that anxious Ss find significantly fewer Rorschach plates repellent than non-anxious Ss do, whereas no significant difference was found for the strength of these judgments.

Since the predictions were of a speculative nature rather than based on previous experimentation, some ad hoc reasoning might be in order to aid in future studies of this kind:
(a) Anxious Ss apparently tend to react more strongly to emotionally toned pictures and thus prefer the "stronger" judgments in general. This trend, however, does not appear consistently for all types of stimuli and the generalization cannot be pushed too far.

(a) Cartoons of an "aggressive" or "macabre" type as used in this study tend to evoke stronger humorous judgments in the less anxious Ss, although they are more frequently judged humorous by the non-anxious S. It may be possible that anxious Ss tended to conform in their judgment to the overall characteristics of "cartoons" in general although these pictures did not necessarily amuse them, whereas non-anxious Ss rated only those cartoons as humorous which really gave them a laugh - and in doing so rated them stronger. This result, then, would be mainly due to a "conformist" trend in the anxious Ss group.

(c) As far as the Rorschach plates are concerned, it was expected that they are anxiety provoking because of their ambiguity and thus more often judged repellent by anxious Ss. However, this ambiguity is more often interpreted as repellent by the non-anxious Ss than the anxious Ss. It might be possible that this is due to a trend of "conformism" on the part of the anxious Ss similar to the one observed in cartoons, i.e. that they hesitate to interpret ambiguity as repellent and prefer the more innocuous-sounding "humorous" or "exciting" ratings. It appears worthwhile to investigate this area further in future studies.

B. Stress.

The only variable that showed any significant influence of mild situational stress was logcircling. Here the unpredicted result appeared that Ss under stress made fewer circles than Ss under non-stress conditions. This result may very well be an artefact of the instructions (pg. 55). It is possible that the instruction of Ss under stress conditions to make real circles and not "just go back and forth with the foot," not given to Ss under non-stress conditions in this form, worked as an unintended alteration

of the task and led to under stress conditions to make "better" but fewer circles per minute.

The overall result, then, of the study of stress as a source of variance for the selected tasks is that none of the variables under study was significantly influenced by the stress condition employed here. A number of factors may have been involved in this:

(a) First, one might wonder if a sufficient and constant level of stress can be maintained throughout a fairly long testing session by the means used in this study. However, if this were all that was involved, one might expect a significant influence of stress on some of the tasks, which was not substantiated by the results.

(b) A second possibility is that the stress employed was not strong enough. Reviewing the literature in which similar types of stress were employed, one finds a considerable number of ambiguous or negative results so that the present outcome is not wholly a surprise. However it would seem likely that the strength of situational stress was not the main factor involved in the outcome of the results on stress influence.

(c) A third possibility is that the type of stress employed does not affect the selected tasks. This would seem to be the most reasonable conclusion from the analysis of results. As mentioned before, in many studies employing similar kinds of stress results were ambigous. The present study shows that pure situational stress applied systematically to many variables but unaided by other sources of stress is not sufficient to effect the performance of many psychological functions. This does not mean, of course, that no kind of psychological stress has any effect on performance. Effects of psychological

stress can perhaps be more effectively studied when it is possible to get S more involved in the situation, which we were unable to do for a number of reasons. It would seem necessary to insure that S is actually convinced that failure on a task is going to affect his personal future well-being in a way related to his individual motivational structure, meeting some already existing individual threat expectancy in the S. This, of course, has been very rarely done in previous studies and no sufficient evidence exists that stress in this form will effect the kind of tasks used in this study. But it is felt that, if any, this kind of stress would lead to a more successful experimentation and that threat and failure alone are an inadequate means of studying stress effects.

C Interaction of Anxiety and Stress.

Anxiety-stress interaction effects reached significance ($p < .01$) only for pneumograph and cardiograph reactions, with high anxiety Ss under stress and low anxiety Ss under non-stress conditions showing the lowest number of reactions in both scores. This result was not predicted, gains credibility, however, by the fact that it occurs in two variables and by similar, though insignificant trends in the other two physiological variables. The meaning of this result, i.e. that high anxious Ss under non-stress conditions show more physiological reactivity to emotionally arousing stimuli than low anxious Ss, but that under stress conditions this trend is reversed, deserves further study. Similar results have appeared in the literature, where it has been pointed out that "high anxiety" refers to "general unstructured" anxiety which - under stress -- may well turn into a concrete "structured" form in which S shows less general reactivity and inability to cope with the situation because of

improved cognitive functioning in a concrete threat situation. It has also been suggested that this change in physiological reactivity as well as in successful performance from an "unstructured" to a "structured" anxiety may be complementary, i.e. that it is less present in Ss with low general anxiety (S w e n e y, 1961)

D Additional Analyses.

Categories of Emotionally Toned Pictures: It was hypothesized that the more emotionally toned pictures would elicit more physiological responses and be viewed for shorter periods by all Ss than more neutral pictures. Categories as a source of variance reaches a significance of .001 for all psychophysiological variables and for viewing time, thus confirming that significant differences between categories do exist. The mean number of reactions for each category tends to be lower in all measures for category IV (gangs, police, riots) and I (corpses), and higher for categories VII (macabre cartoons) and VIII (TAT). Although during the constructions of the series it was felt that categories I through IV would be the most anxiety arousing because of their realistic, aggressive content in the light of these results it seems possible that this was not the case. Macabre cartoons and TAT pictures (and to some extent also aggressive cartoons and Rorschach plates) consistently elicit more responses than categories I to IV. This result can be interpreted more convincingly by considering the common characteristics of these two groups of pictures. It would appear that not only emotionally arousing content but also complexity or "obviousness" contributed to this result, i.e. that pictures that were more difficult to comprehend elicited more responses than those that were self-explanatory. Since degree of mental activity is a well known source of

stimulation of psychophysiological reactivity, this interpretation is just as likely as the other and it remains for further studies to separate these two possible sources of variation. Viewing (and judgement) time apparently follows this general result, more time being taken to view and judge the more ambiguous pictures.

Tapping: Pressure was consistently stronger when tapping was performed with the non-dominant hand, whereas the number of taps was higher for the dominant hand. This result is not unexpected and indicates that while performance with the dominant hand is better, the non-dominant hand has to exert more force in order to reach an optimal performance. One could compare this result with the observation that the less skilled person is usually more clumsy in a motor task whereas the skilled person performs such tasks with ease and least effort. The difference between first and last trial shows that fatigue was successfully produced by the six tapping periods, reducing performance to a significant degree. The tapping scores during the simultaneous steadiness task show that simultaneous work of this kind consistently increased tapping performance both with the dominant or the non-dominant hand. Even though the sequence of tapping trials was not counterbalanced in this study, it would appear that this result is no artefact. The simultaneous tapping and steadiness tasks were performed at the end of the tapping experiments so that a decrease as a result of fatigue rather than an increase might have been expected. Even though the steadiness task was performed singly for one minute before the simultaneous work, this cannot be considered a long enough resting period to explain such a large "recovery", particularly since "resting periods" of the same length alternating for each hand, had been given in the earlier part of the

experiment as well. As a tentative interpretation one might assume that simultaneous work of the type used here tends to distract attention from tapping, thus causing the tapping to be performed with more ease, with less tension. This interpretation follows the one given for the difference between dominant and non-dominant hand above. It is further supported by the significant interaction between dominant-non-dominant hand and simultaneous-non-simultaneous work, suggesting that the difference between hands can be increased by further "relaxation" through the distraction of a simultaneous task.

Reaction Time. Performance was consistently faster for all subgroups on regularly cued trials - a result well known from the literature on the topic.

Steadiness Task. It will be remembered that the difference score used in the analysis was computed by means of comparing single steadiness performance with simultaneous performance, i.e. the difference score expressed the loss of steadiness in simultaneous as compared to single performance. Parallel to the results on simultaneous tapping, this score shows improved steadiness for the non-dominant hand as compared to the dominant hand in all subgroups. Since in the sequence of tasks right handed performance was always required first, one might assume that learning did not seriously enter into this result. As a possible interpretation it might be pointed out that the tapping performance - the "active" part of the simultaneous work - probably required less effort from the S when he was working with his skilled hand, and that consequently he was able to improve his steadiness performance when tapping with the dominant and doing

a steadiness task with the non-dominant hand.

Flicker Fusion Frequency. FFF was consistently lower in all subgroups for ascending trials as compared to descending trials. This result is well known from the literature on FFF.

Category Test. Speed on series III was consistantly faster than on series II. This is clearly the result of learning on this task. The same applies to the error score on series III which is superior to that on series II.

Tachistoscope. Neutral words were consistently perceived faster than "taboo" words, a result well known in the literature on "perceptual defense" although its interpretation has been the subject of much dispute. The present experiment was not designed to enter into this discussion.

Intelligence Tests. The difference between five subtests of the intelligence test was significant at the .001 level. The overall means reveal a particularly low score on analogies and a high score on cubes. This result may be due to peculiarities of the sample (age group, general situation) and the fact that only an abbreviated version of the test was given. If this result should occur repeatedly, a revision of standard scores for this test would seem to be indicated.

V. Results II: Intercorrelation and Factor Analysis

Since all variables except one (legcircling) did not show significant differences between stress and non-stress groups, a separate factor analysis for stress and non-stress groups was not indicated. Consequently, correlations could be computed for all Ss jointly after legcircling had been excluded from the variables to be analyzed.

Since the available computer programs limited the number of variables to be analyzed, 40 of the total of 57 variables were selected. In this selection, the decision could not, as originally intended, be based on the importance of anxiety as a source of variance for the individual variable since the variance analyses described in the preceding chapters did not produce sufficient data for such a selection. Instead, the decision to retain or to exclude a particular variable was based on the principle that any variable very similar to another should be dropped and that at least one score of each task should be retained. As an exception to this rule legcircling was dropped because results for stress and non-stress groups differed significantly and because it was felt that this result was probably an artefact. The variables selected for factor analysis are listed in table 78 (appendix).

In addition to the transformations described for the analysis of individual variables (pg. 65 f), a number of transformations of scores were made before entering them into the correlational analysis. These transformations were:

1) Two variables were summed over subtests (intelligence subtests, Categor Test error score) since it was felt that no additional

information was gained by the analysis of subtests and that the sum was a more reliable score than one of the subtest scores.

2) For a large number of variables only part of the scores used in the variance analysis could be entered because of program limitations, e.g. only reactions on picture categories I + II, V, and VI + VII were used in all psychophysiological measurements.

3) For two variables (Operational time estimation and time estimation from memory) a square root transformation was made; it was felt that these transformations would help meet the more stringent requirements for normality of distribution called for in a correlational analysis.

4) A difference score was used in tachistoscope recognition threshold since this score contains the essential information originally expressed in two scores.

5) For all MMPI scales a prime scale score was used instead of the original scale score, eliminating the overlap between scales as well as between MMPI scales and the anxiety scale. Reasons for this procedure have already been discussed in the preceding chapter. The prime scale score employed here differs from the standard prime score in the literature in two respects. (a) All items which were contained in the anxiety scale were removed from the MMPI scales. (b) In order to not reduce the length of the scales too much, overlap items between two or more scales were arbitrarily assigned to one of the scales. The number of overlap items assigned to each of the scales participating in the overlap was proportionate to the original length of the scale.

With these alterations data were repunched on IBM cards and a 40 x 40 correlational analysis was done. Table 80 (appendix) presents

the means and SDs of all variables as they were entered into the correlational analysis. Table 79 presents the complete intercorrelation matrix. The average correlation coefficient rho is .13422 N for the correlational analysis was 283[1]. The matrix was then read into the computer (with all diagonal values entered as 1.000) and a modified principal axis factor analysis (L u n n e b o r g and W r i g h t, 1958) was performed. Eighteen factors were extracted. A number of checks were performed to determine the number of significant factors. (a) During factorization, the lambda value was constantly checked. Lambda dropped below 1.000 after factor 16 (Kaiser's criterion for the significance of the number of common factors, H a r m a n, 1961, pg. 363), but factor 17 and 18 were nevertheless extracted. (b) Guilford and Lacey's criterion that the product of the two highest factor loadings must not fall below 1 divided by the square root of elements in the matrix (T h o u s o n, 1951, pg. 122) indicated that factor 17 was the last significant common factor. (c) Coomb's criterion indicated that 16 factors could be considered as significant (C a t t e l l, 1952, pg. 299). (d) A chi^2 test for the significance of common factors (H a r m a n, 1961, pg. 377) indicated the same. (e) The residual matrix R_{16} contained only a few values that were slightly beyond the .05 level of significance for the original correlation matrix and none that were beyond the .01 level. It was concluded therefore, that 16 factors would be sufficient to describe the total variance contained in the correlation matrix. Table 81 presents the unrotated factor loadings.

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[1] Nine Ss had to be excluded from the correlational analysis because their scores on variables 25 to 40 (psychophysiological reactions to pictures) were based on too short viewing intervals.

This 16 x 40 factor matrix was then entered into a simplified analytic rotation program (H o r s t, W r i g h t, L u n n e b o r g and M e r e d i t h, 1958). Table 82 (appendix) contains the complete rotated matrix, and the insert table on pages 96 and 97 contains a simplified version of this matrix in which only significant coefficients have been presented. With an average correlation coefficient rho of .134, sigma for factor loadings is .125 (H a r m a n, 1961), so that factor loadings of .250 or more can be considered as suggestive and coefficients of .375 and more can be considered as significant. With zero values defined as .12 and less, the rotated matrix fulfills Bargmann's criterion of simple structure (B a r g m a n n, 1955).

Simplified Rotated Factor Loadings*

		I	II	III	IV	V	VI	VII
1	A Scale							73
2	[illegible]						-25	66
3	Pp' Scale				-35			61
4	Pa' Scale				-26			57
5	Pt' Scale							85
6	Sc' Scale							84
7	Ma' Scale					-27		41
8	Si' Scale							45
9	D' Scale							25
10	Hy' Scale							
11	Intelligence		70	+30				
12	Operational Time Est.		75					
13	Cat. Test, Time	-42						
14	Pict. J. Time I, II	37						
15	Pict. J. Time V	86						
16	Pict. J. Time VI, VII	64						
17	Cardio I, II	49			44			
18	Cardio V	39			51	30		
19	Cardio VI, VII	48			24			
20	Systol. Blood Press				73			
21	Myogr. I, II							
22	Myogr. V							
23	Myogr. VI, VII							
24	Pneumogr. I, II	29						
25	Pneumogr. V	27						
26	Pneumogr VI, VII	3						
27	GSR I, II	27						
28	GSR V	32						
29	GSR VI, VII	32						
30	Steadiness Task							
31	Tapping Pressure					36	26	
32	Tapping Speed		25			78		
33	Memory Time Estim.		-32	28				
34	Auto. Movem. Time						-75	
35	Auto. Movem. dir. chgs.						76	
36	BSConduntance				32			
37	Tach. Recogn. Time							
38	Flicker Fus. Frequ.			82				
39	R-Time							
40	Cat. Test, Errors							

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*Loadings below .24 omitted

	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
						-26			
						29			
						26			
	56								29
	72								
						85			
			-25						-35
									-44
		84							
		82							
		86							
							72		
							66		
							74		
								78	
								75	
								78	
			58			29			
			62						
	71		40						
				53	-40	-31			
				78					
					79				
									68

VI. Discussion of Factor Analysis Results.

The table on the preceding pages presents the factor loading matrix, simplified by rearrangement of the order of variables and by omission of all loadings below .25, i.e., below a confidence level of .05. An inspection of this table shows that only five of the 16 factors contain significant loadings on the personality questionnaire data. Four other factors show loadings on specific kinds of variables only, and six other factors on more than one particular kind of measurement, not including personality questionnaire data. The first group of factors will be tentatively named "personality factors", the second group "specific factors", and the third group "ability factors" Each group of factors will be discussed separately. A summary of all factors with tentative factor names is presented in the table on page 99.

A. Specific Factors.

Factors VI, IX, XIV, and XI have loadings only in one particular function, e.g. factor VI shows highly significant loadings only on the two dotting movement variables, plus a barely significant loading on tapping pressure). It is impossible to identify such factors with any meaningful general psychological function comprising more than the variables involved. This does not mean, of course, that in another analysis with a different set of measurements these would not also show up as specific factors. In the context of this study, however, they will be conventionally named "specific factors", expressing the fact that here the highest amount of variance in a particular area of behaviors is related to one variance source or measurement. A brief naming of the four specific factors will be sufficient here:

Tentative Factor Identification.

No.	Name (Markers)	Contributors	Relevance
I	Decision Time	Physiological Reactivity	Ability
II	Intelligence	Time Estimation	Ability
III	Visual Discrimination	Intelligence, Memory Time Estimation	Ability
IV	Psychopathic Unresponsiveness	Cardiac Reactivity, Basic Skin Conductance	Personality
V	Fine Motor Speed	Cardiac Reactivity, Low Ma-Scale	Ability
VI	Autokinetic Movement		Specific
VII	Maladjustment on Questionnaire		Personality
VIII	Manic-Depression	Memory Time Estimation	Personality
IX	Muscle Reactivity		Specific
X	Motor Coordination		Ability
XI	Reaction to Emotionally Stimulating Words	Basic Skin Conductance	Ability
XII	Reaction Time	Skin Conductance, Steadiness	Ability
XIII	Hysteria	Low Anxiety, Low Basic Skin Conductance	Personality
XIV	Pneumograph Reactivity		Specific
XV	Galvanic Skin Reactivity		Specific
XVI	Elated Superficiality	Low Cardiac Reactivity To Picture Categ. VI/VII	Personality

Factor VI: "Autokinetic movement" (Specific factor) Ss who report many direction changes of autokinetic movement tend to have shorter times till report of first movement. A barely significant loading on tapping pressure will not be considered for interpretation.

Factor VI: "Muscle Reactivity" (Specific factor). Shows only significant loadings on three myograph measurements.

Factor XV: "Pneumograph Reactivity" (Specific factor). Shows only significant loadings on three pneumograph measurements.

Factor XV: "Galvanic Skin Reactivity" (Specific factor). Shows only significant loadings on [illegible] measurements.

It might be added that the appearance of specific factors of this kind seems to be a peculiarity of factor analysis. Whenever more than one measurement of a particular area of behavior is used, the high covariance within this particular area of behavior causes the appearance of a specific factor.

B. Ability factors.

Factors I, II, III, [illegible] all show loadings on more than one particular kind of behavior measurement, but no appreciable loadings on the personality questionnaire data. The separation of these factors from the group of "personality factors" is artificial with respect to the importance and validity of these factors. It is introduced here simply because the main interest of this study was the exploration of the relationship between personality variables and certain functions. For the factors named "ability factors" this relationship cannot be clearly identified, even though it may exist, because of lack of adequate markers that have established

meaning as personality variables.

No attempt will be made to give more than a brief description of these ability factors or to compare them with established factors in the literature. This study was not designed to provide an adequate coverage of ability variables for such a comparison.

Factor I: Decision Time (Ability factor). The meaning of this factor is clearly established by variables 38, 39, and 40 as well as 12 (These are the variable numbers used in the appendix tables; these variables are nos. 12, 14, 15, and 16 in the simplified table pgs. 85 and 37; variable 13 carries a negative loading because reciprocals were used in the analysis). All of these are measurements of time needed to make a decision about different kinds of material, namely about the emotionally toned pictures of three different types and the material of Halstead's Category test. Lower loadings are found for cardiac, breathing, and galvanic skin reactivity. It is possible that the ratings of physiological reactivity may be somewhat correlated with the time the S looked at the material through an experimental artefact, although an attempt was made to exclude this influence. It may be assumed that the loadings of these psychophysiological variables on factor I express this artificial relationship.

Factor II: Intelligence (Ability factor). The only other variables besides the intelligence measure that show appreciable loadings on this factor are the two time estimation tasks (operational and from memory). Apparently, higher intelligence test scores and the ability for time estimation are highly related. It should be noted that on operational time estimation all groups of Ss consistently

underestimated the actual time of 10 sec. (Table 46), whereas on time estimation from memory (Table 52), there was a tendency for overestimation of the actual time of 1 min. Thus, the positive loading of operational time estimation and the negative loading of time estimation from memory on factor XI both indicate that the more correct time estimation correlates positively with intelligence test scores.

Factor XII: Visual Discrimination (Ability factor). This factor is characterized by a high loading on flicker fusion frequency (number per decsecond, two trials). Small contributory loadings are found for intelligence and for time estimation from memory, indicating that high discriminatory ability is positively related to intelligence but negatively to accurate time estimation from memory (considering the direction of time estimation as in the preceding factor). This latter result is not readily understandable but it may well be an artefact since the significance of this loading barely reaches the .05 level of confidence.

Factor XI: Fine Motor Speed (Ability factor). Marker variable for this factor is tapping speed, other loading variables are tapping precision, cardiac reactivity to Koraschach plate and low Ma-scores. It is not surprising that the other fine motor variable, steadiness, shows no appreciable loading since previous analyses have repeatedly demonstrated that no common factor for the whole area of "fine motor ability" can be found. (Guilford, 1958). No interpretation is available for the fact that cardiac reactivity and Ma-scores load on this factor, but it should be noted that all loadings are rather small. Therefore this factor was not considered as a [illegible]

Factor X: Motor Coordination (Ability factor). Three highly significant loadings characterize this factor, higher tapping pressure, poorer steadiness on simultaneous work as compared to single performance, and higher time estimation from memory for one minute of tapping. For interpretation purposes, this factor might be easier to imagine with reversed signs, i.e. low tapping pressure, better steadiness and lower (i.e. more correct) time estimation. Since in the tapping task, Ss were only asked to perform as fast as possible, low tapping pressure might be indicative of greater ease in tapping performance. Both loadings can be interpreted as a motor coordination factor. The additional loading of lower time estimation for a one minute tapping task will not be considered for interpretation as time estimation per se, since it is possible that this tendencey to shorter estimates results from the fact that Ss were estimating tapping time. In other words, Ss who performed with greater ease on tapping might tend to estimate the time spent on tapping as relatively shorter whereas Ss who had more difficulty on this task likely overestimated the time spent on it.

Factor XI: Reaction to Emotionally Stimulating Words (Ability factor). This factor has highly significant loadings on the tachistoscopic difference score and on basic skin conductance level. A high difference score in recognition between emotionally stimulating and neutral words might be interpreted as a tendency towards stronger emotional reactions towards the emotionally stimulating words. The additional loading of basic skin conductance on this factor indicates that this stronger reaction can be found in Ss whose skin conductance level during a resting period is higher; as some previous studies have found, higher skin conductance level may be related to the general

reactivity level, an interpretation which finds some support in the present findings.

Factor XII: Reaction Time (Ability factor). The highest loadings of this factor are found on reaction time, with contributory loadings on basic skin conductance and on hand steadiness. The interpretation of these contributory loadings in the context of the limited material of this study is difficult. It points to a factor that - viewed with reversed signs - (similar to factor X) shows fast reaction time and good hand steadiness (keeping the pressure constant on a rubber ball with visual control by means of a pointer). In this context, high skin conductance may be seen as a sign of alertness although this meaning is not altogether established.

C. Personality Factors.

The somewhat artificial separation of personality factors from other common factors was made to characterize a group of factors emerging in this study which have high loadings on well-known personality marker variables, the MMPI and anxiety scales. It has already been pointed out that other common factors of this study might well be considered as "personality factors", but that their identification as such was not possible for lack of marker variables. An attempt will be made to relate the personality factors of this study to others reported in the literature. Since the meaning of these factors in the personality area is of primary interest, the tentative factor name will be chosen from this meaning rather than from the loadings of functional variables.

Factor IV. "Psychopathic Unresponsiveness" Viewed with reversed signs, the highest loadings of this factor are on low systolic blood pressure and low cardiac reactivity (principal cues of strategy I, XI, and

V (as well as on VI and VII with less significant loadings). This factor also has a relatively high loading on the psychopathia scale and a barely significant loading on the paranoia scale. This combination of loadings may be interpreted as a certain lack of emotional responsiveness, or lack of concern, found in more psychopathic personalities. The additional loading of low basic skin conductance may be seen in support of this interpretation, since this variable can be interpreted as poor attentiveness.

In the available literature, only one study reports factors that include the meaning of psychopathia, of paranoia ("suspiciousness"), and the relationships of blood pressure and GSC to these factors (C a t t e l l and S c h e i e r, 1961, pg. 134). In this study, blood pressure level as well as GSC are found related to a psychopathia factor, whereas cardiac reactivity was not included in this study.

Factor VII: "Disturbed Thinking, Verbal Complaints and Emotionality". This factor deserves particular attention since this is the one that has the highest loading on the anxiety measurement used in this study. The other loadings of this factor were more or less predictable from the outcome of the variance analysis in the first part of this study. No substantial loadings are found for any of the variables except for MMPI-scales. All of the MMPI-scales have significant loadings, except Hy and D although in this analysis prime scales rather than the original scales had been employed, thus eliminating the artificial correlations between scales caused by item-overlap.

Beyond these findings, factor analysis permits a more detailed inspection of the interrelationship of MMPI-scales. The highest loadings of this factor are on Pt and Sc, indicating a content of disturbed

thinking and neuroticism which - in this analysis - appears to be inseparable from anxiety since high loadings for these two scales do not appear on any other factors. Supporting this interpretation are loadings on Hd, Pa, Pp and Si, all in the same direction, indicating lack of social integration, verbal somatic complaints and suspiciousness. Considering these findings, one wonders if this factor might not be best described as maladjustment expressed in questionnaire data. This interpretation seems to be preferable to any more specific meaning derived from particular scales.

There is certainly no evidence supporting an interpretation that this is in any way a particular anxiety factor. Contrary to some of the other scales that do have substantial loadings on separate factors, anxiety can not be considered a separate factor in the context of this study. It appears that anxiety as measured here is part of a general maladjustment syndrome which has previously been found to be related to outside criteria of social maladjustment and neuroticism (W e l s h and D a h l s t r o m, 1956, E y s e n c k, 1956).

Factor VIII: "Mania-Depression". Contrary to factor VI this factor is clearly defined by three highly significant loadings on MMPI scales, i.e. on scale D, Ma, and Si. This is easily recognizable as a mania-depression factor with loadings on the D scale and on the Ma scale in opposite directions. In the range of normal personality, the mania-depression dimension has often been identified as extraversion-introversion dimension. In this study, the high loading on Si lends additional support to such an interpretation. This factor has repeatedly been found in the literature (C a t t e l l, 1957, E y s e n c k, 1957,) and appears to be one of the few well

established factor dimensions of personality. On other variables this factor has contributory loadings on time estimation from memory only. This would point to a more correct estimation of time by Ss high on the Ma scale whereas Ss on the introversive-depressive end of this factor tend to overestimate, a result that confirms theories and findings on the structure of introversive personalities.

Factor XIII: "Hysteria". This factor is characterized by a very high loading on the hysteria scale and smaller, only barely significant loadings on the hypochondriasis scale, the anxiety scale, the paranoia scale, and on basic skin conductance. It seems to be mostly a factor of immaturity and neurotic tendencies.. It is of interest to note that this is the only other factor that the A scale has any loadings on. Whereas on factor VII the A-scale appeared to be only part of a general maladjustment syndrome, in factor XIII anxiety contributes to a specific neuroticism factor of the hysteria type. This is contrary to many assumptions made about hysteria, particularly that anxiety is bound and not consciously accessable in hysteria. The scale combination in this factor is also contrary to Eysenck's view that hysteria is the extroversive end of the neuroticism dimension, since loadings on three scales indicative of extraversion (D, Ma, Si) are absent. On the other hand, the loadings of this factor on the Hd scale confirm the old observation of MMPI users that Hd and Hy correlate in psychosomatic reactions ("the psychosomatic V" with low D between high Hd and Hy). A very small loading on Pa may be interpreted as adding a note of sensitivity, irritability and suspiciousness. At the high end of this factor (high Hy), low basic skin conductance shows a contributory loading which cannot very readily be integrated into the meaning of this factor. If any, this loading

may have the meaning of a certain lack of concern with external stimuli and low attentiveness to external stimuli which may be the result of hypochondriacal overconcern of the S with himself.

Factor XVI: "Elated superficiality". Although this factor was still found to be valid as a common factor in the analysis, it should be remembered that it is the last one extracted that may well be very specific to one of the variables only. However, we find in addition to the main loading (Errors on category test) loadings on cardiac reactivity to pictures of category VI and VII, on time for category test and on the Me scale. It characterizes a factor of low accuracy and high speed on the category test, of low reactivity to relatively complex pictures on the cardiac measurement and of hypomanic elatedness which gives the impression of a factor that may well have a meaning in the personality realm. It may be called "elated superficiality" or "hypomanic superficiality".

Summary

Fifty-eight variables selected from various psychological functions were studied. These included physiological, psychophysiological, simple motor and perceptual and complex behavioral functions as well as intelligence and personality tests. 292 young, healthy German males participated in the tests. They were selected as representing the highest and lowest 30% on an anxiety scale, matched for intelligence. High and low anxiety groups were randomly assigned to conditions of mild situational stress and non-stress.

For each variable an individual statistical analysis was performed. Later 40 variables were selected for factor analysis. Results were as follows: (a) None of the variables under investigation was significantly influenced by stress and non-stress conditions of testing. (b) Fifteen out of 36 hypotheses concerning anxiety level were confirmed. These were primarily hypotheses made about questionnaire data, whereas those concerning other behavioral measures were for the most part not confirmed. (c) Sixteen significant factors were extracted four of which were interpreted as specific and seven as "ability" factors (i.e. not involving significant loadings on personality marker variables). The remaining factors were interpreted as (1) psychopathic unresponsiveness, (2) maladjustment as expressed on questionnaires, (3) mania-depression, (4) hysteria, and (5) elated superficiality.

Results of the individual analyses as well as the factor analysis were discussed with reference to relevant literature in respect to the general topics of this study, anxiety and stress. Additional results concerning the variables under investigation were briefly discussed.

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APPENDIX

TABLES 5 - 82

T A B L E 5

Means and Standard Deviations of Galvanic Skin Conductance, Basic Resting Level (Square Root of Microampere) (Var. 1)

	Stress		Non - Stress	
	AM	SD	AM	SD
High Anxiety	5.64	o.9c	5.69	1.1o
Low Anxiety	5.62	o.94	5.48	o.92

T A B L E 6

Summary of Variance Analysis for Var. 1

Source of Variance	df	MS	F	p
Anxiety	1	1.o4o	1.o9	ns
Stress	1	c.14o	o.15	ns
A x S	1	o.668	o.7o	ns
Error	286	o.954		

T A B L E 7

Chi^2 Test of Conductance Level Type, Rising or Constant (Var. 2)

Group	No. of Ss Rising	No. of Ss Constant
HA s	11	62
LA s	7	66
HA ns	7	66
LA ns	17	56

$chi^2 = 7.453$

df = 3

p = ns

TABLE 8

Means and Standard Deviations of Systolic Blood Pressure (Var.3)

	Stress		Non - Stress	
	AM	SD	AM	SD
High Anxiety	113.63	1o.24	112.87	13,47
Low Anxiety	114.79	9.77	112.53	11.74

TABLE 9

Summary of Variance Analysis for Var. 3

Source of Variance	df	MS	F	p
Anxiety	1	11.1o	o.84	ns
Stress	1	165.8o	1.26	ns
A x S	1	42.8o	o.32	ns
Error	296	131.72		

TABLE 1o

Means and Standard Deviations of Diastolic Blood Pressure (Var.4)

	Stress		Non - Stress	
	AM	SD		SD
High Anxiety	63.15	9.67	[illegible]	.71
Low Anxiety	61.1o	11.45	62.[illegible]	[illegible]

TABLE 11

Summary of Variance Analysis for Var. 4

Source of Variance	df	MS	F	p
Anxiety	1	31.oo	o.3o	ns
Stress	1	5.9o	o.o4	ns
A x S	1	144.1o	1.39	ns
Error	2o8	1o3.72		

T A B L E 12

Means and Standard Deviations of
Pulse Pressure (Var. 5)

	Stress		Non - Stress	
	AM	SD	AM	SD
High Anxiety	5o.48	11.99	51.36	12.8o
Low Anxiety	53.7o	13.5o	5o.27	13.57

T A B L E 13

Summary of Variance Analysis for Var. 5

Source of Variance	df	MS	F	p
Anxiety	1	83.56	o.49	ns
Stress	1	118.27	o.69	ns
A x S	1	337.65	1.98	ns
Error	288	17o.9o		

T A B L E 14

Means and Standard Deviations of
Number of Galvanic Skin Reactions to all Pictures, Cate-
Categories I-VIII (Var.6)

	Groups								
	HAs		LAs		HAns		LAns		
Category	AM	SD	AM	SD	AM	SD	AM	SD	Total AM
I	3.29	1.87	3.8o	2.12	3.74	1.58	3.23	1.64	3.54
II	3.3o	1.73	3.26	1.64	3.32	1.5o	2.94	1.95	3.21
III	3.4o	1.66	3.56	2.o3	3.2o	1.83	3.34	1.42	3.38
IV	3.53	1.93	3.21	1.91	2.86	1.7o	3.55	1.73	3.27
V	4.37	1.62	3.87	1.44	4.17	1.54	3.85	1.54	4.o7
VI	4.34	1.65	4.3o	1.77	4.3o	1.93	3.94	1.85	4.15
VII	4.13	1.8o	.36	1.9o	4.o6	1.65	3.98	1.69	4.14
VIII	3.55	1.75	3.95	1.77	3.96	1.93	3.92	1.88	3.85
AM Groups	3.74		3.79		3.7o		3.6o		
AM Stress	S: 3.76				NS: 3.6o				
AM Anxiety	HA: 3.71				LA: 3.7o				

T A B L E 15

Summary of Variance Analysis for Var. 6

Source of Variance	df	MS	F	p
SS[illegible]	260	26.38		
Anxiety	1	0.18	0.007	ns
Stress	1	6.40	6.24	ns
A x S	1	3.18	0.12	ns
Error (b)	257	26.73		
SSbs	1827	3.74		
Categories	7	44.26	12.33	.001
C x A		3.25	0.90	ns
C x S		1.19	0.33	ns
C x A x S	7	5.25	1.46	ns
Error (wc)	1799	3.59		
SST	2087	6.58		

T A B L E 16

Means and Standard Deviations of Number of Pneumo-graph Reactions to all Pictures, Categories I-VIII (Var.7)

Groups

Category	HAs AM	HAs SD	LAs AM	LAs SD	HAns AM	HAns SD	LAns AM	LAns SD	C Total
I	2.37	1.38	3.82	1.98	3.48	1.70	3.07	1.34	3.35
II	3.58	1.84	3.58	1.52	3.91	1.97	3.28	1.73	3.60
III	3.42	1.47	3.92	1.71	3.90	1.60	3.16	1.47	3.62
IV	2.92	1.29	3.52	1.59	3.24	1.34	3.03	1.45	3.19
V	3.94	1.43	4.09	1.44	4.31	1.37	3.39	1.32	3.95
VI	3.08	1.60	3.53	1.66	3.41	1.74	3.30	1.66	3.33
VII	3.46	1.63	3.91	1.89	4.12	1.75	3.47	1.61	3.75
VIII	3.06	1.70	3.47	1.64	3.85	1.53	3.61	1.72	3.50
AM Groups	3.30		3.73		3.78		3.28		
AM Stress			S: 3.52				NS: 3.54		
AM Anxiety			HA: 3.54				LA: 3.52		

TABLE 17

Summary of Variance Analysis for Var. 7

Source of Variance	df	MS	F	p
S's	263	26.36		
Anxiety	1	0.12	0.007	ns
Stress	1	0.84	0.014	ns
A x S	1	121.88	6.73	.01
Error (b)	260	18.62		
Sws	1840	3.10		
Categories	7	16.12	5.28	<.001
C x A	7	3.73	1.22	ns
C x S	7	2.79	0.92	ns
C x S x A	7	1.31	0.43	ns
Error (wc)	1820	3.05		
Sst	2111	4.41		

TABLE 18

Means and Standard Deviations of

Number of Cardiograph Reactions to all Pictures, Categories I-VIII
(Var 8)

Subscripts: A = Anxiety, S = Stress

Groups

	HAs		LAs		HAns		LAns		
Category	AM	SD	AM	SD	AM	SD	AM	SD	Tot l
I	3.82	1.79	3.95	1.80	3.83	1.73	3.12	1.67	3.68
II	3.44	1.67	3.91	1.81	4.04	1.91	3.60	1.84	3.75
III	3.81	1.69	4.12	1.81	4.04	1.81	3.29	1.60	3.82
IV	3.43	1.61	3.31	1.66	3.36	1.84	3.24	1.81	3.34
V	3.71	1.37	4.47	1.61	4.04	1.35	3.74	1.44	4.00
VI	3.92	1.80	4.54	1.94	4.59	2.01	3.68	1.76	4.32
VII	4.24	1.74	4.44	1.63	4.10	1.99	3.62	1.86	4.11
VIII	3.88	1.70	4.56	2.04	4.53	1.90	3.62	1.58	4.21
AM Groups	3.78		4.16		4.07		3.51		
AM Stress			S: 3.98				NS: 3.80		
AM Anxiety			HA: 3.92				LA: 3.86		

T A B L E 19

Summary of Variance Analysis for Var. 8

Source of Variance	df	MS	F	p
SSs	261	15.4o		
Anxiety	1	2.28	o.151	ns
Stress	1	15.91	1.o6	ns
A x S	1	114.3o	7.583	.o1
Error (b)	58	15.o7		
SSws	1834	3.63		
Categories	7	23.58	6.558	.oo1
C x A	7	1.72	o.483	ns
C x S	7	2.75	o.77	ns
C x S x A	7	3.69	1.o4	ns
Error (w)	1806	3.57		
SSt	2o95	5.1o		

T A B L E 2o

Means and Standard Deviations of Number of Mycoplasma Reactions to all Pictures, Categories I-VIII (Var. 9)

	Groups								
	HAs		LAs		HAns		LAns		
Category	AM	SD	AM	SD	AM	SD	AM	SD	Total M
I	7.o3	1.76	6.96	1.61	6.99	1.43	6.39	1.65	6.84
II	7.o9	1.46	7.o2	1.39	7.27	1.77	6.19	1.7o	6.92
III	6.98	1.6o	6.76	1.52	7.13	1.77	6.o1	1.51	6.74
IV	6.37	1.63	6.78	1.49	6.54	1.63	6.21	1.71	6.49
V	6.95	1.39	6.9o	1.28	6.97	1.23	6.41	1.59	6.84
VI	6.66	1.76	7.o2	1.45	7.2o	1.4o	6.9[illegible]	1.46	6.96
VII	7.52	1.62	7.72	1.26	7.37	1.52	6.9[illegible]	1.66	7.32
VIII	6.79	1.5o	7.35	1.41	7.1o	1.59	6.56	1.4o	6.9[illegible]
AM Groups	6.92		7.o7		7.o8		6.46		
AM Stress			S: 7.oo				NS: 6.78		
AM Anxiety			HA: 7.oo				LA: 6.79		

T A B L E 21

Summary of Variance Analysis for Var. 9

Source of Variance	df	MS	F	p
SSs	264	32.93		
Anxiety	1	24.17	0.74	ns
Stress	1	25.77	0.79	ns
A x S	1	81.40	2.48	ns
Error (b)	261	32.81		
SSws	1855	2.85		
Categories	7	18.00	6.43	<.001
C x A	7	5.05	1.80	ns
C x S	7	2.80	1.00	ns
C x S x A	7	0.98	0.35	ns
Error (wc)	1827	2.80		
SSt	2119	6.60		

T A B L E 22

Means and Standard Deviations of

Tapping Pressure for Dominant and Non-Dominant Hand (Sum of ix Standardized Voltmeter Readings) (Var. 10)

Groups	Dominant	SD	Non-Dominant	SD
HAs	21.63	3.09	24.85	2.01
NAs	21.79	2.36	25.22	2.39
HAns	22.29	3.04	24.07	2.11
NAns	22.95	1.72	25.60	1.76

TABLE 23

Summary of Variance Analysis for Var. 10

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	42.58	0.68	ns
Dominant-Non Dominant	1	582.73	57.43	.001
A x DNDom	1	11.33	1.12	ns
Error (b)	144	62.52		
Error (w)	144	10.14		
Test 2 (Non Stress Groups)				
Anxiety	1	87.67	1.75	ns
Dominant-Non Dominant	1	359.50	49.94	.001
A x DNDom	1	14.03	1.95	ns
Error (b)	144	49.98		
Error (w)	144	7.20		
Test 3 (High Anxiety Groups)				
Stress	1	0.28	0.01	ns
Dominant-Non Dominant	1	456.25	52.85	.001
S x DNDom	1	37.76	4.37	.05
Error (b)	144	52.85		
Error (w)	144	8.63		
Test 4 (Low Anxiety Groups)				
Stress	1	5.34	0.09	ns
Dominant-Non Dominant	1	472.64	54.24	.001
S x DNDom	1	0.94	0.11	ns
Error (b)	144	59.65		
Error (w)	144	8.71		

T A B L E 24

Means and Standard Deviations of Number of Taps for Dominant and Non-Dominant Hand, First and Last 10 sec. (Var. 11)

	First Trial				Last Trial			
	Dom.		Non-Dom.		Dom.		Non-Dom.	
Groups	AM	SD	AM	SD	AM	SD	AM	SD
HA s	52.70	5.25	49.11	5.31	45.66	3.15	41.95	3.27
LA s	53.22	3.42	48.73	3.51	46.84	3.74	40.38	3.96
HA ns	52.78	2.83	49.10	3.01	46.96	4.78	41.73	4.56
LA ns	52.44	3.98	49.99	3.78	46.60	3.39	42.27	3.56

T A B L E 25

Summary of Variance Analysis for Var. 11

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)	1	0.80	0.01	ns
Anxiety	1	7638.10	238.30	.001
Dominant-Non Dominant	1	3038.10	113.94	.001
First-Last	1	2.10	0.07	ns
A x DNDom	1	120.90	4.53	.05
A x FLast	1	39.40	1.96	ns
DNDom x FLast	1	31.10	1.55	ns
A x DNDom x FLast	1	97.31		
Error (b)	144	26.28		
Error (w)	432			
Test 2 (Non Stress Groups)				
Anxiety	1	4.70	0.05	ns
Dominant-Non Dominant	1	9524.50	185.97	.001
First-Last	1	2249.00	62.88	.001
A x DNDom	1	1.50	0.04	ns
A x FLast	1	41.80	1.17	ns
DNDom x FLast	1	106.80	4.60	.05
A x DNDom x FLast	1	0.80	0.03	ns
Error (b)	144	104.91		
Error (w)	432	31.36		

Source of Variance	df	MS	F	p
Test 3 (High Anxiety Groups)				
Stress	1	11.90	0.12	ns
Dominant-Non Dominant	1	6849.50	231.46	.001
First-Last	1	2400.20	76.37	.001
S x DNDom	1	9.40	0.32	ns
S x FLast	1	24.30	0.77	ns
DNDom x FLast	1	25.50	1.13	ns
S x DNDom x FLast	1	18.30	0.81	ns
Error (b)	144	102.57		
Error (w)	432	27.90		
Test 4 (Low Anxiety Groups)				
Stress	1	41.90	0.42	ns
Dominant-Non Dominant	1	7294.70	194.31	.001
First-Last	1	2367.40	92.50	.001
S x DNDom	1	12.40	0.33	ns
S x FLast	1	157.80	5.09	.05
DNDom x FLast	1	134.00	6.48	.05
S x DNDom x FLast	1	0.50	0.02	ns
Error (b)	144	99.65		
Error (w)	432	29.74		

TABLE 26

Means of Number of Taps During 1 Minute Trials for Dominant and Non-Dominant Hand, with and without Tremorgraph (Var. 12)

	Without Tremorgraph		With Tremorgraph	
Groups	Dom	Non-Dom	Dom	Non-Dom
HA s	223.22	210.95	254.66	217.52
LA s	230.40	209.19	255.56	218.07
HA ns	224.96	206.66	253.16	217.27
LA ns	234.62	213.93	257.86	227.05

TABLE 27

Summary of Variance Analysis for Var. 12

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	443.00	0.16	ns
Dominant-Non Dominant	1	47231.00	96.28	.001
Tremograph-No tremograph	1	106858.00	142.56	.001
A x DNDom	1	171.00	0.35	ns
A x TNTrem	1	786.00	1.05	ns
DNDom x TNTrem	1	15381.00	49.19	.001
A x DND x TNTrem	1	684.00	2.19	ns
Error (b)	144	2812.06		
Error (w)	432	517.61		
Test 2 (Non Stress Groups)				
Anxiety	1	9021.00	3.15	ns
Dominant-Non Dominant	1	51599.00	91.16	.001
Tremograph-No Tremograph	1	101932.00	178.88	.001
A x DNDom.	1	30.00	0.05	ns
A x TNTrem.	1	38.00	0.07	ns
DNDom x TNTrem	1	6988.00	20.37	.001
A x DNDom x TNTrem	1	543.00	1.58	ns
Error (b)	144	2867.27		
Error (w)	432	492.94		
Test 3 (High Anxiety Groups)				
Stress	1	186.00	0.07	ns
Dominant-Non dominant	1	53868.00	113.03	.001
Tremograph-No Tremograph	1	97927.00	162.34	.001
S x DNDom	1	0.00	0.00	ns
S x TNTrem	1	206.00	0.34	ns
DNDom x TNTrem	1	16464.00	54.24	.001
S x DNDom x TNTrem	1	483.00	1.59	ns
Error (b)	144	2800.73		
Error (w)	432	461.10		

Source of Variance	df	MS	F	p
Test 4 (Low Anxiety Groups)				
Stress	1	3704.00	1.29	ns
Dominant-Non Dominant	1	45104.00	77.76	.001
Tremograph-No Tremograph	1	110978.00	154.96	.001
S x DNDom	1	68.00	0.12	ns
S x TNTrem	1	502.00	0.70	ns
DNDom x TNTrem	1	6344.00	18.01	.001
S x DNDom x TNTrem	1	306.00	0.87	ns
Error (b)	144	2878.61		
Error (w)	432	549.44		

T A B L E 28

Means and Standard Deviations of Reaction Time, summed over 30 regularly spaced and 30 irregularly spaced trials(Var.13)

	Regular		Irregular	
Groups	AM	SD	AM	SD
HA s	627.3	34.0	685.3	39.8
LA s	624.4	32.3	680.7	39.2
HA ns	660.5	31.6	708.0	32.5
LA ns	641.2	30.1	670.4	26.3

T A B L E 29

Analysis of Variance Analysis for Var.13

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	550.00	.04	ns
Regular-Irregular	1	230280.00	60.52	.001
A x Regular	1	10.00	.00	ns
Error (b)	144	14183.33		
Error (w)	144	2728.58		

Source of Variance	df	MS	F	p
Test 2 (Non-Stress Groups)				
Anxiety	1	59270.00	2.62	ns
Regular-Irregular	1	107400.00	60.52	.001
A x RIrregular	1	6440.00	3.56	ns
Error (b)	141	22643.26		
Error (w)	144	1774.72		
Test 3 (High Anxiety Groups)				
Stress	1	61570.00	2.69	ns
Regular-Irregular	1	195730.00	87.25	.001
S x RIrregular	1	1320.00	.59	ns
Error (b)	144	22923.06		
Error (w)	144	2243.40		
Test 4 (Low Anxiety Groups)				
Stress	1	790.00	.06	ns
Regular-Irregular	1	133350.00	59.01	.001
S x RIrregular	1	13420.00	5.94	.05
Error (b)	144	13903.54		
Error (w)	144	2259.93		

T A B L E 30

Means of Difference Score on Steadiness Task (Effect of Simultaneous Work) for Dominant and Non-Dominant Hand (Var.14)

Groups	Dominant Hand	Non-Dom.Hand
HA s	27.73	20.58
LA s	39.32	15.23
HA ns	35.18	18.79
LA ns	32.45	26.10

T A B L E 31

Summary of Variance Analysis for Var.14

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	599.68	.72	ns
Dominant-Non-Dominant	1	17835.26	25.62	.001
A x DNDom.	1	5198.03	7.28	.01
Error (b)	144	959.23		
Error (w)	144	714.14		
Test 2 (Non-Stress Groups)				
Anxiety	1	382.04	.38	ns
Dominant-Non-Dominant	1	9-36.98	12.75	.001
A x DNDom.	1	1835.02	2.48	ns
Error (b)	144	1000.43		
Error (w)	144	740.31		
Test 3 (High Anxiety Groups)				
Stress	1	575.69	.70	ns
Dominant-Non-Dominant	1	10155.09	14.41	.001
S x DNDom.	1	1537.32	2.18	ns
Error (b)	144	717.79		
Error (w)	144	704.62		
Test 4 (Low Anxiety Groups)				
Stress	1	292.00	.25	ns
Dominant-Non-Dominant	1	16908.51	22.55	.001
S x DNDom.	1	5734.37	7.65	.01
Error (b)	144	1151.87		
Error (w)	144	749.83		

T A B L E 32

Means and Standard Deviations of
Number of Circles Made with the Foor in One Minute (Var. 15)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	87.25	19.83	94.15	20.86
Low Anxiety	87.63	19.90	93.60	18.17

T A B L E 33

Summary of Variance Analysis for Var. 15

Source of Variance	df	MS	F	p
Anxiety	1	1.40	0.00	ns
Stress	1	3025.80	7.68	.01
A x S	1	15.20	0.04	ns
Error	288	393.96		

T A B L E 34

Means and Standard Deviations of
Reciprocal of Time in Seconds to Report of First
Autokinetic Movement (multiplied by 10000) (Var. 16)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	479.14	350.27	471.27	330.16
Low Anxiety	487.89	351.64	425.73	365.61

T A B L E 35

Summary of Varance Analysis for Var. 16

Source of Variance	df	MS	F	p
Anxiety	1	24697.00	0.20	ns
Stress	1	89459.00	0.72	ns
A x S	1	53859.00	0.43	ns
Error	1	123951.00		

T A B L E 36

Means and Standard Deviations of Total Extent of Autokinetic Movement Seen in 3 Minutes (cm) (Var.17)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	56.54	86.37	60.78	72.60
Low Anxiety	54.88	69.52	51.00	74.26

T A B L E 37

Summary of Variance Analysis for Var.17

Source of Variance	df	MS	F	p
Anxiety	1	2308.49	.40	ns
Stress	1	5.01	.00	ns
A x S	1	1261.43	.21	ns
Error	288	5849.62		

T A B L E 38

Means and Standard Deviations of Reciprocal of Number of Direction Changes Reported For Autokinetic Movement (multiplied by 100) (Var.18)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	22.07	28.97	23.77	26.46
Low Anxiety	23.06	24.36	30.19	31.41

T A B L E 39

Summary of Variance Analysis for Var.18

Source of Variance	df	MS	F	p
Anxiety	1	1001.75	1.27	ns
Stress	1	1419.38	1.79	ns
A x S	1	536.18	.68	ns
Error	288	792.88		

TABLE 40

Chi^2 Test of Number of Subjects Reporting Circular Autokinetic Movement (Var.19)

Group	yes	no
HA s	51	22
LA s	42	31
HA ns	44	29
LA ns	37	36

$chi^2 = 5.746$
df = 3
p = ns

TABLE 41

Chi^2 Test of Number of Subjects Reporting Three-Dimensional Autokinetic Movement (Var.20)

Group	yes	no
HA s	8	65
LA s	8	65
HA ns	14	59
LA ns	6	67

$chi^2 = 4.562$
df = 3
p = ns

TABLE 42

Means of Flicker Fusion Frequency, Summed over Five Ascending anf Five Descending Trials (Var.21)

Groups	Ascending	Descending
HA s	151.52	163.94
LA s	148.75	160.01
HA ns	148.56	162.48
LA ns	148.04	159.94

T A B L E 43

Summary of Variance Analysis of Var.21

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	818.90	5.61	.05
Ascending-Descending	1	10237.80	152.88	.001
A x ADesc.	1	24.70	.37	ns
Error (b)	144	146.05		
Error (w)	144	66.96		
Test 2 (Non-Stress Groups				
Anxiety	1	170.30	1.77	ns
Ascending-Descending	1	12168.60	157.84	.001
A x ADesc.	1	74.10	.96	ns
Error (b)	144	96.20		
Error (w)	144	77.09		
Test 3 (High Anxiety Groups)				
Stress	1	357.50	3.03	ns
Ascending-Descending	1	12664.30	146.56	.001
S x ADesc.	1	40.50	.47	ns
Error (b)	144	117.88		
Error (w)		86.41		
Test 4 (Low Anxiety Groups)				
Stress	1	10.90	.09	ns
Ascending-Descending	1	9792.50	169.85	.001
S x Adesc.	1	7.90	.14	ns
Error (b)	144	124.37		
Error (w)	144	57.65		

T A B L E 44

Means and Standard Deviations of Variability Scores for Flicker Fusion Frequency (Var.22)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	5.58	3.16	5.23	2.24
Low Anxiety	5.71	3.55	6.21	3.35

T A B L E 45

Summary of Variance Analysis for Var.22

Source of Variance	df	MS	F	p
Anxiety	1	22.75	2.31	ns
Stress	1	.45	.05	ns
A x S	1	12.95	1.32	ns
Error	288	9.84		

T A B L E 46

Means and Standard Deviations of Operational Time Estimation, Sum of Estimates ober Five Trials (Var.23)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	34.20	15.70	34.78	14.25
Low Anxiety	34.96	18.36	35.86	16.45

T A B L E 47

Summary of Variance Analysis of Var.23

Source of Variance	df	MS	F	p
Anxiety	1	15.40	.23	ns
Stress	1	40.03	.15	ns
A x S	1	1.84	.01	ns
Error	288	268.09		

T A B L E 48

Means and Standard Deviations of Operational Time Estimation, Estimate for Trial 1 minus Estimate for Trial 5 plus 20 (Var.24)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	18.66	3.24	19.64	2.76
Low Anxiety	18.95	2.81	19.11	2.38

TABLE 49

Summary of Variance Analysis of Var.24

Source of Variance	df	MS	F	p
Anxiety	1	.87	.11	ns
Stress	1	25.33	3.15	ns
A x S	1	13.17	1.64	ns
Error	288	8.03		

TABLE 50

Means and Standard Deviations of Time Estimation from Memory for 10 Seconds Tapping (Var.25)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	32.07	23.31	35.70	22.07
Low Anxiety	35.03	23.25	30.40	20.42

TABLE 51

Summary of Variance Analysis of Var.25

Source of Variance	df	MS	F	p
Anxiety	1	100.06	.20	ns
Stress	1	18.17	.04	ns
A x S	1	1245.40	2.47	ns
Error		504.00		

TABLE 52

Means and Standard Deviations of Time Estimation from Memory for One Minute Tapping (Var.26)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	60.45	37.59	74.11	57.30
Low Anxiety	61.92	40.46	58.96	29.96

T A B L E 53

Summary of Variance Analysis of Var.26

Source of Variance	df	MS	F	p
Anxiety	1	3417.90	1.86	ns
Stress	1	2088.90	1.14	ns
A x S	1	5038.80	2.75	ns
Error	288	1832.88		

T A B L E 54

Means and Standard Deviations of Speed Scores on Adaptation of Halstead Category Test, First Series (Reciprocals of Time in Seconds Summed over 10 Trials, multiplied by 10000) (Var.27)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	244.00	100.14	252.67	117.99
Low Anxiety	224.62	95.21	262.59	109.72

T A B L E 55

Summary of Variance Analysis of Var.27

Source of Variance	df	MS	F	p
Anxiety	1	1633.00	.14	ns
Stress	1	39713.00	3.48	ns
A x S	1	15664.00	1.37	ns
Error	288	11419.44		

T A B L E 56

Means of Time Scores on Adaptation of Halstead Category Test, Second and Third Series (Time in Sec. Summed over 30 Trials of Each Series) (Var.28)

Groups	Series II	Series III
HA s	103.72	93.23
LA s	117.91	94.16
HA ns	122.82	86.82
LA ns	103.56	83.55

T A B L E 57

Summary of Variance Analysis of Var.28

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	4174.20	1.11	ns
W	1	21404.30	11.64	.001
A x W	1	3208.70	1.74	ns
Error (b)	144	3750.69		
Error (w)	144	1838.11		
Test 2 (Non-Stress Groups)				
Anxiety	1	9267.20	1.46	ns
W	1	57260.00	19.32	.001
A x W	1	4663.90	1.57	ns
Error (b)	144	6354.39		
Error (w)	144	2963.25		
Test 3 (High Anxiety Groups)				
Stress	1	2936.80	.46	ns
W	1	39449.50	14.02	.001
S x W	1	11873.20	4.22	.05
Error (b)	144	6310.14		
Error (w)	144	2814.11		
Test 4 (Low Anxiety Groups)				
Stress	1	11381.30	3.04	ns
W	1	34959.10	17.59	.001
S x W	1	255.10	1.28	ns
Error (b)	144	3744.94		
Error (w)	144	1987.25		

T A B L E 58

Means and Standard Deviations of Errors on Adaptation of Halstead Category Test, First Series (Sum of Errors over 10 Trials) (Var.29)

	Stress		Non-Stress	
	AM	SD	AM	SD
High Anxiety	6.26	2.52	6.63	2.21
Low Anxiety	5.55	2.73	6.41	2.37

T A B L E 59

Summary of Variance Analysis of Var.29

Source of Variance	df	MS	F	p
Anxiety	1	15.83	2.57	ns
Stress	1	27.74	4.50	.05
A x S	1	4.44	.72	ns
Error	288	6.17		

T A B L E 60

Means of Errors on Adaptation of Halstead Category Test, Second and Third Series (Sum of Errors over 30 Trials of Each Series) (Var.30)

Groups	Series II	Series III
HA s	15.74	6.63
LA s	14.49	6.08
HA ns	17.79	8.19
LA ns	16.83	5.88

T A B L E 61

Summary of Variance Analysis of Var.30

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	38.63	1.52	ns
N	1	5602.20	154.92	.001
A x N	1	8.91	.25	ns
Error (b)	144	38.63		
Error (w)	144	35.16		
Test 2 (Non-Stress Groups)				
Anxiety	1	195.62	4.47	.05
N	1	2715.75	219.75	.001
A x N	1	33.57	.96	ns
Error (b)	144	43.80		
Error (w)	144	35.11		

Source of Variance	df	MS	F	p
Test 3 (High Anxiety Groups)				
Stress	1	238.68	5.25	.05
W	1	6390.26	200.64	.001
S x W	1	4.44	.14	ns
Error (b)	144	45.46		
Error (w)	144	31.85		
Test 4 (Low Anxiety Groups)				
Stress	1	83.34	2.25	ns
W	1	6847.25	173.68	.001
S x W	1	118.48	3.01	ns
Error (b)	144	36.97		
Error (w)	144	39.43		

T A B L E 62

Means of Tachistoscopic Recognition Threshold: Sum of Number of Exposures of Increasing Length Needed for all Eight Emotionally Stimulating and for all Eight Neutral Words (Var.31)

Groups	Emotion.Stimul. Words	Neutral Words
HA s	50.58	47.75
LA s	49.97	46.55
HA ns	49.85	47.37
LA ns	49.11	46.36

T A B L E 63

Summary of Variance Analysis of Var.31

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	59.67	.95	ns
Emot.Stim.-Neutral	1	712.11	43.41	.001
A x E Neut.	1	6.62	.40	ns
Error (b)	144	62.92		
Error (w)	144	16.40		

Source of Variance	df	MS	F	p
Test 2 (Non-Stress Groups)				
Anxiety	1	54.36	.64	ns
Emot.Stim.-Neutral	1	504.99	39.24	.001
A x ESNeut.	1	1.67	.13	ns
Error (b)	144	85.39		
Error (w)		12.87		
Test 3 (High Anxiety Groups)				
Stress	1	22.47	.35	ns
Emot.Stim.-Neutral	1	512.91	30.88	.001
A x ESNeut.	1	2.14	.13	ns
Error (b)	144	64.85		
Error (w)		16.61		
Test 4 (Low Anxiety Groups)				
Stress	1	19.25	.23	ns
Emot.Stim.-Neutral	1	702.77	55.48	.001
A x ESNeut.	1	7.57	.60	ns
Error (b)	144	83.47		
Error (w)	144	12.67		

TABLE 64

Means and Standard Deviations of Time Spent Observing Emotionally Stimulating Pictures, in Half-Seconds, Summed over Five Pictures of Each Categoy (Var.32)

Category	HA s		LA s		HA ns		LA ns		Total
	M	SD	M	SD	M	SD	M	SD	M
I	145.52	25.78	147.48	28.45	134.33	24.74	127.14	40.52	138.-
II	146.45	20.39	139.08	25.03	136.19	24.74	119.86	33.19	135.4-
III	150.68	20.22	129.93	27.34	139.03	22.98	123.47	35.89	135.7
IV	138.63	19.62	127.44	32.19	122.15	28.53	115.84	30.81	126.-
V	152.22	24.30	144.33	30.61	145.90	20.31	121.23	57.41	140.9-
VI	137.73	31.97	129.31	32.97	128.23	35.69	123.48	27.42	129.69
VII	171.85	24.77	159.53	31.28	151.42	28.65	142.40	30.64	156.30
VIII	166.78	27.38	151.64	28.89	156.08	28.01	138.49	37.91	155.75
M(Group)	151.23		142.36		139.17		126.50		
M(Stress)	S: 146.79				NS: 132.83				
M(Anxiety)	HA: 145.20				LA: 134.43				

T A B L E 65

Summary of Variance Anelysis of Var. 32

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	23009.00	1.16	ns
Categories	1	22663.00	16.94	.001
A x C	1	1539.00	1.15	ns
Error (b)	144	19975.97		
Error (w)	144	1337.10		
Test 2 (Non-Stress Groups)				
Anxiety	1	46896.00	3.64	ns
Categories	1	14140.00	17.50	.001
A x C	1	1746.86	2.16	ns
Error (b)	144	12873.84		
Error (w)	144	808.06		
Test 3 (High Anxiety Groups)				
Stress	1	42507.00	2.32	ns
Categories	1	20027.14	20.69	.001
S x C	1	704.57	.73	ns
Error (b)	144	13303.52		
Error (w)	144	967.87		
Test 4 (Low Anxiety Groups)				
Stress	1	73462.00	5.12	.05
Categories	1	17556.00	14.91	.001
S x C	1	1801.29	1.53	ns
Error (b)	144	14346.29		
Error (w)	144	1177.29		

T A B L E 66

Kruskal-Wallis One Way Anelysis of Variance of No. of Pictures Category I - III ("shockers") judged as repellent (Var. 33)

High Anxiety N = 132 $\frac{R^2}{N}$ = 2413130.73

Low Anxiety N = 139 $\frac{R^2}{N}$ = 2599446.56

H 0.00 p n.s.

T A BL E 67

Kruskal-Wallis One Way Analysis of Variance of "Repellent Score" for all Pictures of Categories I - III (Var. 34)

High Anxiety	N = 132	$\frac{R^2}{N}$ = 2530395.27
Low Anxiety	N = 139	$\frac{R^2}{N}$ = 2491865.62

H 1.627 p n.s.

T A B L E 68

Kruskal-Wallis One Way Analysis of Variance of No. of Pictures of Categories VI and VII ("Cartoons") judged as humerous (Var. 35)

High Anxiety	N = 132	$\frac{R^2}{N}$ = 2575034.33
Low Anxiety	N = 139	$\frac{R^2}{N}$ = 2496822.09

H 9.9928 p .01

T A B L E 69

Kruskal-Wallis One Way Analysis of Variance of "Humerous Score" for all Pictures of Categories VI and VII (Var. 36)

High Anxiety	N = 132	$\frac{R^2}{N}$ = 2388316.52
Low Anxiety	N = 139	$\frac{R^2}{N}$ = 2705253.76

H 13.233 p .001

T A B L E 70a

Kruskal-Wallis One Way Analysis of Variance of No. of Pictures Category V ("Rorschach") judged as repellent (Var. 37a)

High Anxiety	N = 132	$\frac{R^2}{N}$ = 2357746.38
Low Anxiety	N = 139	$\frac{R^2}{N}$ = 2695357.81

H 6.645 p .01

T A B L E 70b

Kruskal-Wallis One Way Analysis of Variance of "Repellent Score" for the Picture Category V ("Rorschach") (Var. 37b)

High Anxiety N = 132 $\frac{R^2}{N}$ = 2524305.94

Low Anxiety N = 139 $\frac{R^2}{N}$ = 2469155.94

H 0.00 p n.s.

T A B L E 71

Kruskal-Wallis One Way Analysis of Variance of "Overall Judgement Score" (Var. 38)

High Anxiety N = 32 $\frac{R^2}{N}$ = 2306740.48

Low Anxiety N = 139 $\frac{R^2}{N}$ = 2157657.65

H = 3.6943 p .01

T A B L E 72

Means and Standard Deviations of Time in Minutes Required to Complete MMPI (Var. 39)

Groups	M	SD
HA	33.27	16.68
LA	85.95	17.64

T A B L E 73

Summary of Variance Analysis of Var. 39

Source of Variance	df	MS	F	p
Anxiety	1	34.60	.12	ns
Error	288	299.54		

T A B L E 74

Means and Standard Deviations of Intelligence Test Scores (Standard Scores on Each of Five Subt) (Var.40-44)

Var. No.	Subtest	High Anxiety Groups HA s AM	SD	HA ns AM	SD	Total AM
40	Sentence Complet.	94.64	5.10	93.99	5.36	94.31
41	Analogies	94.47	6.34	93.38	6.92	93.92
42	Similarities	95.93	3.80	94.71	6.42	95.32
43	Rows of Nos.	94.66	5.81	96.55	6.42	95.60
44	Cubes	98.14	8.53	98.07	7.78	98.10
40-44		95.57		95.34		95.45

	Low Anxiety Groups LA s		LA ns		Total
40	94.12	5.91	94.15	5.41	94.14
41	94.21	7.09	94.64	6.29	94.42
42	97.73	6.19	96.75	6.14	97.24
43	96.56	5.40	96.44	4.28	96.50
44	99.26	7.47	100.86	7.11	100.06
40-44	96.38		96.57		96.47

AM (Stress) S: 95.97 NS: 95.95

T A B L E 75

Summary of Variance Analysis of Var. 40-44

Source of Variance	df	MS	F	p
Test 1 (Stress Groups)				
Anxiety	1	119.20	.56	ns
Subtests	1	492.80	9.07	.001
A x S	1	58.50	1.05	ns
Error (b)	144	214.37		
Error (w)	144	54.30		
Test 2 (Non-Stress Groups)				
Anxiety	1	276.10	1.30	ns
Subtests	1	429.70	13.70	.001
A x S	1	32.32	.62	ns
Error (b)	144	212.88		
Error (w)	144	53.25		

Source of Variance	df	MS	F	p
Test 3 (High Anxiety Groups)				
Stress	1	9.40	.04	ns
Subtests	1	390.20	7.00	.001
S x S	1	47.28	.87	ns
Error (b)	144	224.38		
Error (w)	144	55.70		
Test 4 (Low Anxiety Groups)				
Stress	1	6.80	.03	ns
Subtests	1	843.83	16.28	.001
S x S	1	55.10	1.03	ns
Error (b)	144	202.82		
Error (w)	144	51.84		

T A B L E 76

Means and Standard-Deviations for MMPI Raw Scores
(Var.45 - 57)

Var. No.	Scale	High Anxiety M	High Anxiety SD	Low Anxiety M	Low Anxiety SD
45	K	9.78	3.33	14.66	3.35
46	F	13.05	7.09	8.36	5.05
47	L	4.33	2.18	5.92	2.55
48	Hs	8.55	4.55	4.81	4.62
49	D	22.38	5.01	17.81	4.06
50	Hy	18.16	5.10	17.31	4.21
51	Pd	20.95	4.43	16.49	4.57
52	Mf	24.89	4.30	22.71	4.31
53	Pa	13.41	3.73	9.07	3.50
54	Pt	21.60	7.29	8.61	5.56
55	Sc	25.19	9.74	13.42	7.95
56	Ma	21.32	4.81	18.68	3.88
57	Si	35.45	7.71	23.69	6.42

T A B L E 77

Summary of Variance Analysis for Var.45-57

Source of Variance	df	MS	F	p
Var.45 (K-Scale)				
Anxiety	1	1741.00	153.80	.001
Error	288	11.32		

Source of Variance	df	MS	F	p
Var.46 (F-Scale)				
Anxiety	1	1611.60	41.24	.001
Error	288	39.08		
Var.47 (L-Scale)				
Anxiety	1	184.30	32.14	.001
Error	288	5.73		
Var.48 (Hs-Scale)				
Anxiety	1	1020.90	58.20	.001
Error	288	17.54		
Var.49 (D-Scale)				
Anxiety	1	1528.20	71.73	.001
Error	288	21.30		
Var.50 (Hy-Scale)				
Anxiety	1	53.50	2.39	ns
Error	288	22.36		
Var.51 (Pd-Scale)				
Anxiety	1	1451.40	70.56	.001
Error	288	20.59		
Var.52 (Mf-Scale)				
Anxiety	1	346.30	18.34	.001
Error	288	18.88		
Var.53 (Pa-Scale)				
Anxiety	1	1376.60	78.26	.001
Error	288	17.59		
Var.54 (Pt-Scale)				
Anxiety	1	12324.00	288.61	.001
Error	288	42.70		
Var.55 (Sc-Scale)				
Anxiety	1	10108.00	125.01	.001
Error	288	80.85		
Var.56 (Ma-Scale)				
Anxiety	1	507.60	26.00	.001
Error	288	19.52		
Var.57 (Si-Scale)				
Anxiety	1	10096.30	197.80	.001
Error	288	51.04		

T A B L E 78

Consecutive Nos. and Description of Variables used for Correlational and Factorial Analysis (with original Var.Nos.)

Cons. No.	Orig. No.	Description of Var.
1	40+ 44+	Intelligence Test Standard Score (Mean of five subtests' standard scores)
2	58	Anxiety Scale Score
3	48+	Hypochondriasis Prime Scale of MMPI
4	49+	Depression Prime Scale of MMPI
5	50+	Hysteria Prime Scale of MMPI
6	51+	Psychopathic Deviate Prime Scale of MMPI
7	53+	Paranoia Prime Scale of MMPI
8	54+	Psychasthenia Prime Scale of MMPI
9	55+	Schizophrenia Prime Scale of MMPI
10	56+	Mania Prime Scale of MMPI
11	57+	Social Introversion Prime Scale of MMPI
12	27	Speed Scores on Adaptation of Halstead Category Test, First Series (Reciprocal of time in sec. summed over 10 trials x 10000)
13	30+	Errors on Adaptation of Halstead Category Test (Sum of errors over 60 trials of second and third series)
14	31+	Tachistoscopic Recognition Threshold, Difference Between Sum of Number of Exposures Needed for all Eight Emotionally Stimulating Words and for all Eight Neutral Words plus 10
15	13+	Reaction Time, Summed over 30 Regularly Spaced Trials
16	23+	Operational Time Estimation, Square Root of Sum of Estimates over five Trials
17	26+	Time Estimation from Memory for one Minute Tapping (Square Root)
18	16	Reciprocal of Time in Sec. to Report of First Autokinetic Movement (x 10000)
19	18	Reciprocal of Number of Direction Changes Reported for Autokinetic Movement (x 100)
20	21+	Flicker Fusion Frequency, Summed over Five Descending Trials

+ Original Variable is used only in part, as sum or difference score or otherwise transformed

Cons. No.	Orig. No.	Description of Var.
21	10+	Tapping Pressure for Dominant Hand (Sum of six standardized voltmeter readings)
22	11+	No.of Taps for Dominant Hand on First 10 Sec. Trial
23	14+	Difference Score on Steadiness Task (Effect of Simultaneous Work) for Dominant Hand
24	3	Systolic Blood Pressure
25	1	Galvanic Skin Conductance, Basic Resting Level (square root of microampere)
26	7+	Number of Pneumograph Reactions to all Pictures, Category I and II(Death & Destruction)
27	7+	Number of Pneumograph Reactions to all Pictures, Category V (Rorschach Plates)
28	7+	Number of Pneumograph Reactions to all Pictures, Category VI and VII (Cartoons)
29	9+	Number of Myograph Reactions to all Pictures, Category I and II (Death & Destruction)
30	9+	Number of Myograph Reactions to all Pictures, Category V (Rorschach Plates)
31	9+	Number of Myograph Reactions to all Pictures, Category VI and VII (Cartoons)
32	6+	Number of Galvanic Skin Reactions to all Pictures,Category I and II (Death & Destruction)
33	6+	Number of Galvanic Skin Reactions to all Pictures,Category V (Rorschach Plates)
34	6+	Number of Galvanic Skin Reactions to all Pictures,Category VI and VII (Cartoons)
35	8+	Number of Cardiograph Reactions to all Pictures,Category I and II(Death & Destruction)
36	8+	Number of Cardiograph Reactions to all Pictures,Category V (Rorschach Plates)
37	8+	Number of Cardiograph Reactions to all Pictures,Category VI and VII (Cartoons)
38	32+	Time Spent Observing Emotionally Stimulating Pictures, Category I and II
39	32+	Time Spent Observing Emotionally Stimulating Pictures, Category V
40	32+	Time Spent Observing Emotionally Stimulating Pictures, Category VI and VII

TABLE 79

Intercorrelation Matrix

Var.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1															
2	-01														
3	-16	35													
4	-03	16	23												
5	03	-18	05	04											
6	-08	41	35	06	-08										
7	-07	31	34	13	05	39									
8	-11	67	30	18	-13	50	43								
9	-11	49	59	18	-05	55	52	70							
10	-04	20	25	-07	-08	27	21	33	40						
11	00	34	26	32	-02	15	20	31	28	-08					
12	09	-01	00	-05	-02	03	-06	05	04	04	-06				
13	-17	12	25	03	02	00	08	16	13	17	05	-01			
14	-06	-04	04	01	00	-04	03	-03	00	-08	02	-09	-06		
15	-04	06	04	07	00	-07	05	04	-01	-06	11	10	01	06	
16	21	-02	-06	-01	-05	-04	-02	-11	-07	-08	00	-01	-04	-03	-06
17	-04	07	08	09	00	09	01	08	06	08	07	00	06	-08	02
18	-03	04	15	-02	00	08	00	08	-05	11	-06	08	-07	-03	-13
19	02	-05	-10	01	08	-03	01	-08	-04	-13	10	-06	-02	-03	03
20	06	12	-07	-01	-01	00	13	06	05	08	-01	09	-04	07	00
21	02	-08	01	03	-06	06	-01	-07	05	-03	02	06	08	09	-03
22	11	00	-04	04	05	00	09	-03	00	-08	08	-01	-04	13	-07
23	-05	-07	-06	-12	03	-02	-03	-09	-04	-02	-08	-02	02	-08	01
24	04	03	-02	05	05	-16	-13	00	-01	00	08	10	-09	-05	-06
25	-03	07	-03	01	-13	00	-11	05	-02	02	-03	07	02	14	-11
26	-03	04	00	06	05	05	05	03	-02	-04	00	-11	10	-04	-03
27	-06	11	12	10	00	11	05	12	06	06	04	02	12	03	-01
28	04	08	11	12	-05	04	02	02	-01	00	05	-05	04	09	-03
29	-10	07	05	02	-03	07	14	06	08	03	02	-16	10	-01	00
30	-03	08	12	11	-02	09	13	10	11	-05	09	-01	08	01	10
31	-15	-05	05	00	-07	07	09	00	05	-02	-05	-08	06	05	01
32	-02	04	05	10	00	02	02	07	-01	-07	11	-12	-02	06	03
33	-03	12	03	02	-08	04	07	13	04	-04	13	-02	00	00	03
34	00	04	06	10	02	04	00	07	01	00	14	-05	01	00	01
35	00	04	-02	01	02	-07	00	02	-11	-09	-02	-07	-07	-08	08
36	-08	-05	02	-02	00	-02	00	00	-08	00	00	-09	00	-04	-03
37	-05	00	02	03	-06	-05	00	-05	-14	-13	-02	-08	-08	01	04
38	03	06	00	12	-01	00	02	-02	-04	-05	04	-22	-05	-04	06
39	-11	14	12	05	-04	10	12	07	06	-02	04	-25	00	-09	07
40	04	08	00	15	-02	07	07	00	00	-09	07	-24	-05	-05	04

TABLE 79 continued

Ver.	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17	-14													
18	03	05												
19	03	-10	-37											
20	-11	12	10	-09										
21	-04	06	-03	13	09									
22	11	-10	-01	-10	07	16								
23	-01	01	-01	-11	-08	08	-13							
24	-06	02	11	-06	11	-04	02	02						
25	-17	02	04	-02	01	14	00	-05	10					
26	-02	05	-07	08	-08	03	-05	00	-02	06				
27	-01	10	-01	03	01	03	-06	-01	-05	08	43			
28	04	2	03	05	-02	05	-04	-01	-08	05	48	47		
29	-09	-01	-06	09	06	03	-10	03	-09	-03	20	15	06	
30	02	00	-03	05	-03	13	-08	11	-14	04	14	19	10	61
31	-04	-02	-04	14	-02	10	-12	10	-15	00	15	14	21	69
32	-05	01	-07	04	-04	05	-02	07	-10	-03	07	09	04	06
33	10	-01	02	02	-06	-01	-03	-06	-05	-01	06	27	06	07
34	04	-01	01	08	-02	03	-06	00	-09	-10	10	17	14	00
35	-02	00	01	04	02	-05	-01	03	10	05	34	21	18	10
36	11	03	03	-01	-09	03	05	05	12	08	05	24	05	05
37	00	-04	-05	08	-04	-04	02	01	00	07	19	13	29	01
38	11	06	-09	07	-10	-02	-06	07	**-10**	-07	28	17	21	09
39	16	14	-01	-01	-03	-02	-05	00	-09	-11	18	31	16	09
40	16	03	-10	16	-04	-03	-05	05	-17	-12	23	17	28	13

TABLE 79 continued

Var.	30	31	32	33	34	35	36	37	38	39	40
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31	62										
32	12	oo									
33	10	o2	50								
34	o9	-o1	62	55							
35	12	o5	23	21	13						
36	10	o2	o6	20	o7	37					
37	o8	o3	14	12	19	[illegible]	26				
38	o6	o1	23	22	27	31	14	30			
39	o6	o1	20	32	28	33	34	27	63		
40	11	o6	13	17	26	25	14	37	79	64	

T A B L E 80

Means and Standard Deviations of 40 Variables as Entered into Correlational and Factor Analysis

	Variable	AM	SD
1	Intelligence	95.52	08.83
2	A-Scale	24.04	11.37
3	Ma' Scale	03.71	2.73
4	D' Scale	11.76	3.17
5	Hy' Scale	11.33	6.73
6	Pd' Scale	09.28	3.42
7	Pa' Scale	05.86	2.60
8	Pt' Scale	06.51	5.03
9	Sc' Scale	11.05	5.56
10	Ma' Scale	12.18	2.99
11	Si' Scale	13.93	4.53
12	Cat. Test, time, rec.	243.59	106.07
13	Cat. Test, errors	23.23	11.04
14	Tach. Regn. Time Diff.	12.996	5.33
15	R-Time	63.81	10.06
16	Op. Time Estimation	572.89	140.33
17	Memory Time Estimation	77.62	31.13
18	Aut. Mov., time, rec.	445.04	289.66
19	Aut. Mov., dir. chg. rec.	247.47	281.88
20	FFF Descend. Trials	161.62	9.95
21	Tapping pressure	223.58	54.06
22	Tapping speed	52.68	7.01
23	Steadiness Task	34.04	32.75
24	Systol. Blood Press.	113.36	11.41
25	RSCond., microamp.	560.53	98.47
26	Pneumo I + II	69.09	35.56
27	Pneumo V	39.26	17.88
28	Pneumo VI + VII	65.68	36.17
29	Myograph I + II	137.36	44.61
30	Myograph V	68.70	20.69
31	Myograph VI + VII	142.75	48.33
32	GSR I + II	67.41	44.71
33	GSR V	41.21	22.83
34	GSR VI + VII	83.69	43.33
35	Cardiograph I + II	74.08	35.18
36	Cardiograph V	37.85	18.11
37	Cardiograph VI + VII	82.07	38.74
38	Observ. Time I + II	276.36	97.40
39	Observ. Time V	143.45	62.68
40	Observ. Time VI + VII	289.498	95.38

TABLE 81

Unrotated Factor Loading

Var.	F1	F2	F3	F4	F5	F6	F7	F8
1	-10	04	-08	25	27	36	-15	-05
2	50	-21	43	18	-01	-00	-17	-07
3	48	-21	45	04	-05	02	08	16
4	29	02	12	16	25	-10	-21	24
5	-09	01	-08	01	13	25	23	39
6	44	-25	43	-01	-05	10	-05	-11
7	44	-26	34	-05	12	23	-11	00
8	55	-28	57	13	-04	-04	-02	-07
9	49	-36	60	-01	04	09	-01	06
10	17	-22	40	-05	-34	09	23	-05
11	34	-13	20	23	40	-07	-18	16
12	-21	18	31	18	05	11	25	-10
13	18	-04	20	-20	-10	-10	24	31
14	-03	19	08	05	23	-33	-17	11
15	09	-17	-11	-09	11	-12	-04	30
16	01	-14	-26	10	13	39	-22	-19
17	15	09	11	08	-21	06	22	27
18	-04	19	21	20	-29	12	21	-34
19	07	-01	-23	-22	34	02	-08	31
20	-03	20	26	16	10	20	-09	-05
21	01	31	12	00	37	14	18	24
22	-09	13	10	32	33	23	-28	-08
23	-07	-02	-15	-25	-01	28	40	24
24	-16	26	15	34	-07	17	11	03
25	-09	45	24	12	-10	-30	-04	-04
26	41	42	-14	-09	-20	-06	-17	22
27	49	42	-03	03	-17	-07	05	13
28	40	45	-07	02	-17	-10	-21	24
29	36	24	02	-56	17	08	-01	-28
30	40	29	05	-53	32	12	08	-22
31	28	32	03	-72	18	03	00	-22
32	27	-06	-32	21	35	-34	40	-15
33	53	-03	-28	26	21	-24	-34	-33
34	42	-08	-34	26	29	-29	41	-13
35	38	33	-35	18	-17	16	03	-07
36	26	28	-27	17	-19	28	14	-13
37	32	28	-37	17	-15	02	-15	-02
38	31	-07	-58	10	-15	14	-15	10
39	59	-11	-45	13	-25	21	-04	-01
40	44	-03	-41	03	-06	12	-15	06
lambda	4.41	2.27	3.47	2.26	1.75	1.39	1.48	1.44

TABLE 31 continued

Var.	F9	F10	F11	F12	F13	F14	F15	F16
1	10	05	46	05	13	31	-01	03
2	-02	24	11	-11	12	08	-06	-16
3	12	05	-06	24	-17	-15	16	11
4	-19	07	-15	17	-23	22	34	06
5	-13	-09	-14	45	-14	05	-17	44
6	-03	-10	10	-29	-03	-14	03	19
7	05	-11	-15	-02	-00	-07	-25	21
8	-05	-01	06	-04	05	-05	-06	00
9	-02	-02	04	01	11	-10	00	09
10	14	-11	16	13	33	07	-06	04
11	21	02	-03	03	-16	06	14	-20
12	-10	01	37	-17	-21	-10	02	15
13	03	-15	02	30	13	-15	-02	-44
14	01	01	-19	11	13	-05	01	23
15	24	07	-15	-16	-18	05	-24	-17
16	24	-04	33	26	-09	-10	23	-20
17	-13	-07	-21	-30	-11	39	27	-11
18	08	01	-08	13	-38	17	15	08
19	-02	01	24	10	31	-17	03	21
20	15	03	-21	-20	20	47	-34	04
21	04	08	-05	-31	19	-16	21	-17
22	02	-01	-25	04	-03	-26	-20	-21
23	13	20	14	-27	-02	-17	08	-05
24	-06	45	-11	23	14	10	-03	-11
25	01	13	02	-04	43	-11	32	10
26	-11	-14	04	07	-06	03	-30	-06
27	-03	-16	24	09	-13	-03	-12	-11
28	04	-15	34	-02	-24	09	-04	05
29	-02	04	-14	12	08	19	-06	-05
30	03	17	-03	03	-12	04	-13	-02
31	01	05	-04	02	-07	06	06	04
32	01	-01	-02	-02	06	04	-09	05
33	-01	-03	09	06	01	-04	-06	-12
34	02	-11	15	05	-04	09	-03	08
35	-10	29	-11	-02	07	-10	-26	06
36	-05	11	-29	10	07	-41	15	-06
37	07	17	-13	-13	-01	-29	-01	27
38	11	-02	-02	-06	18	21	14	05
39	01	-11	-18	-04	10	07	13	-09
40	02	-01	-00	-06	06	11	09	05

Lambda 1.12

T A B L E 82

Rotated Factor Loadings

Test / Factor	I	II	III	IV	V	VI	VII
1 Intelligence	00	+70	+30	+04	-17	+17	-04
2 A Scale	+11	60	+16	+01	-07	-01	+73
3 Hs'Scale	+03	-14	-14	-03	+02	-25	+66
4 D'Scale	+12	-03	-06	+06	+06	+01	+25
5 Hy'Scale	-04	-02	+05	+12	-01	+13	-10
6 Pd'Scale	+05	-11	+03	-35	+05	-07	+62
7 Pa'Scale	+09	-09	+20	-26	+19	+02	+57
8 Pt'Scale	+01	-15	+08	-03	-05	-09	+85
9 Sc'Scale	-03	-10	+05	-20	00	+01	+84
10 Ma'Scale	-02	-05	+16	-09	-27	-15	+41
11 Si'Scale	+03	+02	-03	+11	+16	+14	+45
12 Cat Test, time, rec.	-42	+17	+05	+12	-13	-08	+09
13 Cat. Test, errors	-05	-14	-18	+04	+07	+02	+20
14 Tech.Regn.Time Diff.	-07	-03	+11	-16	+22	-05	-07
15 R-Time	+07	-14	+03	-03	-07	+05	+03
16 Op. Time Estimation	+22	+75	-23	-03	+11	-15	00
17 Memory Time Estimation	+18	-32	+28	-05	-13	-16	-02
18 Aut.Mov., time, rec.	-08	+07	+14	+11	-12	-75	+01
19 Aut.Mov., dir.reg.rec.	+09	+05	-21	-04	-06	+76	+01
20 FFF Descend. Trials	-06	-05	+82	-01	-00	-00	+01
21 Tapping pressure	-05	+02	+20	-10	+36	+26	-04
22 Tapping speed	-08	+05	+21	00	+78	-02	+01
23 Steadiness Task	+05	00	-10	+04	-24	+14	-06
24 Systol. Blood Press.	-13	+03	+22	+73	-09	+01	+06
25 BSCond., Microamp.	-11	-17	+02	+32	-04	+09	+05
26 Pneumo I + II	+29	-10	00	+02	+02	+14	00
27 Pneumo V	+27	-08	-02	+05	+04	-06	+11
28 Pneumo VI + VII	+28	+04	-02	-12	-03	-06	+01
29 Myograph I + II	+11	-13	+11	-09	-12	+11	+05
30 Myograph V	+06	00	-01	-04	-09	+04	+13
31 Myograph VI + VII	00	-11	-03	-18	-12	+07	-02
32 GSR I + II	+27	-14	+02	-07	+01	+07	-01
33 GSR V	+32	+01	-06	+04	+04	-08	+10
34 GSR VI + VII	+32	-01	-03	-11	-07	00	+02
35 Cardiograph I + II	+49	-12	+12	+44	+05	+07	-01
36 Cardiograph V	+39	-09	-14	+51	+30	-14	+02
37 Cardiograph VI + VII	+48	-14	-13	+24	+16	+03	-05
38 Observ. Time I + II	+87	+06	+01	-07	-11	+09	-04
39 Observ. Time V	+86	-04	00	-02	+06	-12	+08
40 Observ. Time VI + VII	+64	+05	-03	-09	-02	+08	+01
Vp	3.427	1.522	1.346	1.581	1.283	1.571	3.658

TABLE 82 Con'd

Test/Fact.	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	h^2
1	+07	-10	-02	+02	-04	-02	+07	+02	-08	.6704
2	+05	-03	-08	-01	+11	-29	+06	+02	+03	.6866
3	+13	+04	+12	+13	+01	+29	+03	-02	+07	.6881
4	+72	+01	-02	+06	-08	+08	+01	-04	+02	.6259
5	+13	-06	-06	-06	-03	+85	+01	00	00	.7970
6	-12	+01	+05	-10	-19	-04	+02	-03	-24	.6466
7	-08	+11	-10	-06	+06	+26	-05	-05	-11	.6084
8	-01	-01	-05	00	+02	-10	+03	+07	00	.7818
9	-04	+01	+04	00	-06	+10	-05	-04	+06	.7835
10	-40	+06	+03	+06	-20	+10	00	-05	+29	.6048
11	+56	-02	+02	-07	+15	-11	-02	+12	+04	.6328
12	-06	-09	+25	-11	-17	00	+19	+14	-35	.5470
13	-11	+10	+19	-02	+03	+12	+19	+03	+68	.6758
14	+07	+03	-04	+78	+12	+09	-02	+02	+01	.7385
15	+13	-02	+10	+13	+79	-04	00	-01	00	.6997
16	-03	+06	+04	-04	+02	00	-05	-03	+07	.7168
17	+31	-12	+40	-21	-19	-07	+06	-14	+11	.6495
18	+02	+04	+07	+02	-09	+09	00	+02	-13	.6608
19	+03	+05	+05	+02	-07	+10	-01	+02	-12	.6764
20	-01	+01	-01	+01	+01	00	00	00	00	.6787
21	+09	+11	+62	+12	-19	-07	+02	-05	+07	.7118
22	-01	-02	-05	-02	+02	+01	00	-01	+01	.7257
23	-24	+09	+58	-07	+29	+10	-04	-02	-10	.6080
24	+09	-09	-04	-04	+02	00	-02	-03	+06	.6365
25	-04	+02	+09	+53	-40	-31	+05	-06	-02	.7096
26	-01	+17	-14	-05	-04	+04	+72	-03	+04	.6896
27	00	+18	+08	+03	-11	-03	+56	+14	+08	.6138
28	+16	+10	+06	+20	-06	00	+74	-06	-10	.7434
29	+02	+84	-15	-08	-03	-01	-03	-02	+11	.8256
30	+14	+82	+18	+04	+06	+01	00	+08	-08	.7605
31	+03	+86	+02	+04	-02	00	+05	-05	-04	.8146
32	+10	-01	+01	+08	+01	+03	-07	+78	-02	.7340
33	-01	+07	-02	-02	-03	-11	+01	+75	+03	.7080
34	+12	-04	+04	+05	-06	+09	+04	+78	-01	.7627
35	-15	+13	-10	-02	+12	+03	+21	+12	-24	.6508
36	-21	+17	+18	-02	-11	+06	-06	+02	-11	.6834
37	-09	+04	-04	+18	+03	00	+14	00	-44	.6113
38	+06	-04	-01	+04	00	00	00	-02	00	.7945
39	-06	+01	+05	-09	-01	-01	-04	00	+07	.7850
40	+08	+04	-01	00	00	+01	+05	-01	-05	.4413
Vp	1.412	2.349	1.184	1.137	1.183	1.201	1.684	1.907	1.134	